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NATIONAL DAM SAFETY PROGRAM. WYOMING LAKE DAM (DE 00034), JONES--ETC(U)
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1 OF 2
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JONES RIVER BASIN
ISAAC BRANCH, KENT COUNTY
DELAWARE

WYOMING LAKE DAM
DE 00034

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Approved for public release;
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DEPARTMENT OF THE ARMY
Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

April, 1979

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Structural Analysis
Wyoming Lake Dam, N.J.

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)
This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

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410 891

NAPEN-D
Honorable Pierre DuPont

c. The following remedial actions should be completed within six months from the date of approval of this report:

(1) The deteriorating stoplogs should be replaced.

(2) The wall dividing the mill race downstream should be repaired or replaced.

d. The deteriorated trash control at the Mill Road spillway and the deteriorating trashrack at the mill raceway should be repaired or replaced within one year from the date of approval of this report.

A copy of the report is being furnished to Mr. Austin P. Olney, Delaware Department of Natural Resources and Environmental Control, the designated State Office contact for this Program. Within five days of the date of this letter, a copy will also be sent to Congressman Thomas B. Evans. Under the provisions of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, thirty days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

An important aspect of the Dam Safety Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely,

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated

Cy furn:
Mr. Austin P. Olney, Secretary
Department of Natural Resources and
Environmental Control

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT CORPS OF ENGINEERS
CUSTOM HOUSE - 2 D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO

NAPEN-D

Honorable Pierre S. DuPont
Governor of Delaware
Dover, Delaware 19901

21 MAY 1979

Dear Governor DuPont:

Inclosed is the Phase I Inspection Report for Wyoming Lake Dam in Kent County, Delaware which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Wyoming Lake Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in fair overall condition. The dam's spillway is considered inadequate since 10 percent of the Spillway Design Flood-SDF - would overtop the dam. (The SDF, in this instance is the 100 year Flood). To insure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures, and studies within six months from the date of approval of this report. Any remedial measures necessary to insure the adequacy of the spillway and to prevent overtopping should be initiated within calendar year 1980.

b. The following remedial actions should be completed within three months from the date of approval of this report:

(1) The willow trees located on the upstream side of the embankment near the north end of the main spillway should be reduced/cut in height such that a maximum height of five feet is maintained at all times.

(2) Clear debris from the mill race and spillway trash racks.

WYOMING LAKE DAM (DE00034)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 15 December 1978 by Thomas Tyler Moore and Lippincott Engineering Associates, joint venture under contract to the U. S. Army Engineer District, Philadelphia, in accordance with the National Dam Inspection Act, Public Law 92-367.

Wyoming Lake Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in fair overall condition. The dam's spillway is considered inadequate since 10 percent of the Spillway Design Flood-SDF - would overtop the dam. (The SDF, in this instance is the 100 year Flood). To insure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures, and studies within six months from the date of approval of this report. Any remedial measures necessary to insure the adequacy of the spillway and to prevent overtopping should be initiated within calendar year 1980.

b. The following remedial actions should be completed within three months from the date of approval of this report:

(1) The willow trees located on the upstream side of the embankment near the north end of the main spillway should be reduced/cut in height such that a maximum height of five feet is maintained at all times.

(2) Clear debris from the mill race and spillway trash racks.

c. The following remedial actions should be completed within six months from the date of approval of this report:

(1) The deteriorating stoplogs should be replaced.

(2) The wall dividing the mill race downstream should be repaired or replaced.

d. The deteriorated trash control at the Mill Road spillway and the deteriorating trashrack at the mill raceway should be repaired or replaced within one year from the date of approval of this report.

APPROVED: Joel Kallaber LTC
JAMES G. TON
Colonel, Corps of Engineers
District Engineer

DATE: 21 May 1979

JONES RIVER BASIN

Name of Dam: Wyoming Lake Dam
County and State: Kent County, State of Delaware
Inventory Number: DE 00034

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
NAME OF DAM: WYOMING LAKE DAM

Prepared By: Moore & Lippincott - Engineers
490 North DuPont Highway
Dover, Delaware 19901

Prepared For: Department of the Army
Philadelphia District, Corps of Engineers
Custom House - 2D and Chestnut Streets
Philadelphia, Pennsylvania 19106

Date: April, 1979

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Wyoming Lake Dam ID # DE 00034
State Located:	Delaware
County Located:	Kent
Stream:	Isaac Branch
Date of Inspection:	12-15-78 - See First Page of Inspection Sheets 2-04-79

Brief Assessment of General Condition:

Based on visual inspection, available records, calculations and past operational performance, Wyoming Lake Dam is considered to be in fair overall condition. Based upon visual inspection downstream, the hazard potential for this dam has been reduced from "High Hazard Potential" to "Significant Hazard Potential". The existing spillway has a hydraulic capacity equal to 9½% of the peak SDF outflow before the low point of the earthen embankment is overtopped, and is, therefore, considered hydraulically inadequate.

To insure adequacy of the structure the following actions are recommended:

- The willow trees located on the upstream side of the embankment near the north end of the main spillway should be reduced/cut in height such that a maximum height of five feet is maintained at all times. This action should be initiated soon.

- The deteriorated trash control at the Mill Road spillway and the deteriorating trashrack at the Mill Raceway should be repaired or replaced in the future and cleared of all debris.

- The deteriorating stoplogs should be replaced in the near future.

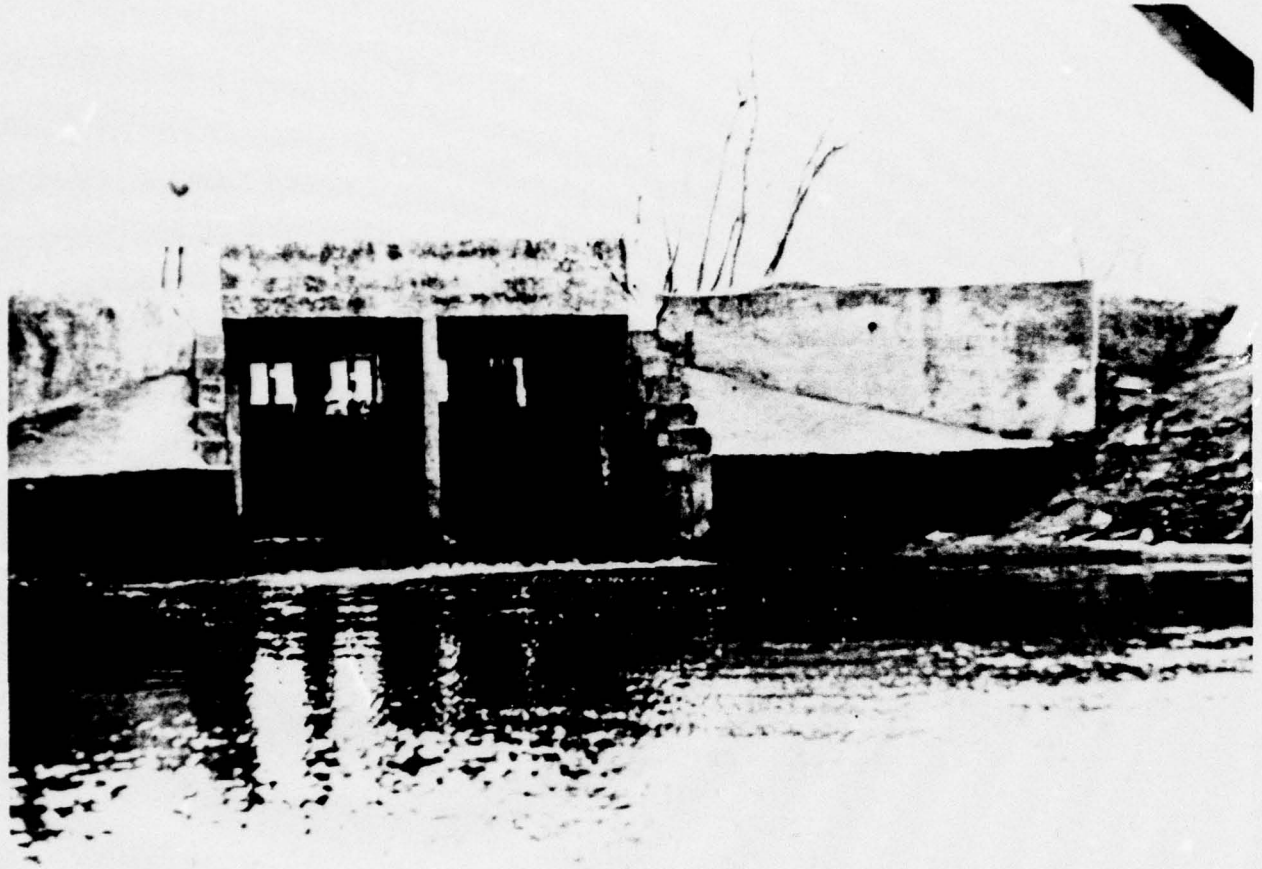
- The wall dividing the Mill Race downstream should be repaired or replaced in the near future.

- A further study should be initiated in the future to evaluate the feasibility of increasing the hydraulic capacity of the spillway.

Moore & Lippincott - Engineers

I. Wayne Lippincott, P.E., P.P.
Project Manager

IWL:bc



OVERALL VIEW
OF
DAM

DEC. 15, 1978

WYOMING LAKE DAM

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigation, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
WYOMING LAKE DAM

SECTION I - PROJECT INFORMATION

1.1 GENERAL

a. Authority

The Dam Inspection Act, Public Law 92-367, dated August 8, 1972, provides for the report herein. The inspection of Wyoming Lake Dam was initiated under Contract DACW61-79-C-0006 with the Department of the Army, Philadelphia District, Corps of Engineers by the engineering firms of Thomas Tyler Moore Associates and Lippincott Engineering Associates, under a joint venture contract.

b. Purpose of Inspection

The purpose of the inspection is to evaluate the general condition of Wyoming Lake Dam and bring to the attention of the Owner those conditions which are a threat to the public. The National Inventory of Dams will be updated by the data accumulated during this inspection.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances

Wyoming Lake Dam consists of a gated spillway within an earthen embankment, at Mill Road Bridge, and a diversion to a gated spillway at the Mill. Each spillway structure is separated by approximately 400 feet. At the bridge, the spillway functions as an overflow structure; at the Mill, the gates are operated as an underflow control. The hydraulic capacity of the spillway structures is controlled by stoplogs connected together to form a gate. From the reservoir the spillways discharge through the concrete box culverts under inlet control conditions. The crest of the Mill Race structure is 1.33 feet lower than the crest of the main structure. The

embankments on either side of the overflow dams are approximately 3 feet higher in elevation than the present crests of the overflow dams.

The lake depth at Wyoming Lake varies, but probes taken during our survey indicate a maximum depth of ten feet$^{+}_{-}$ upstream of the present spillway.

Wyoming Pond extends 2100 feet upstream of the dam axis. The banks of the lake are almost flat to low sloping and are well vegetated.

Downstream of the dam is the main channel and a diversion channel, both of which converge to flow through the recently reconstructed highway culvert. The ground between the two channels is flat and of low relief. A roadway bridge (Rt. 195) and a railroad culvert and embankment are situated immediately downstream of the Wyoming Lake Dam. The roadway bridge is located approximately 150 feet downstream of the dam. Its crest at the low point along the vertical sag curve, is 1.25 feet above normal lake elevation and the combined effective area through the three culverts is 240 square feet. The railroad embankment is 80 feet further downstream. The top of rail is approximately 8.5 feet above the highway (immediately upstream) and is effectively 9.5 feet above normal lake elevation. The effective area of the railroad culvert is 250 square feet.

Downstream of the diversion structure at Wyoming Lake Dam is a Grain Mill with two outbuildings and three corncribs. The elevation of the ground floor of the mill is approximately 5 feet above normal lake elevation; the mill's basement extends to 4 feet below normal lake elevation. Located on the embankment south of the main spillway is a residential dwelling. At the time of the inspection the dwelling was occupied by two persons. The first floor elevation is 7 feet above normal lake elevation while the basement extends approximately 2 feet below normal lake elevation.

b. Location

Wyoming Lake Dam is located on a tributary known as Isaac Branch, approximately 7000 feet upstream of its confluence with the St. Jones River, Kent County, Delaware. Wyoming Lake Dam is also approximately 4000 feet upstream of Moores Lake Dam.

c. Size Classification

The maximum height of the dam is 12 feet. The maximum reservoir volume is approximately 670 acre-feet. Thus, the dam is categorized as "small", based on both the height and storage criteria, i.e., the height is less than forty feet and the storage volume is less than 1000 acre-feet.

d. Hazard Classification

At the immediate location of the dam are located a single house structure and a place of business - the Mill. Immediately downstream of the dam are triple corrugated metal pipe arches through the Route 195 embankment. In our judgement, failure of the dam would result in the loss of less than a few lives and damage to property would not be excessive. Therefore, Wyoming Lake Dam is considered a "Significant Hazard" dam.

e. Ownership

The owner of the dam is George Short, 302 South Walnut Street, Milford, Delaware.

f. Purpose of Dam

The purpose of the dam was to impound water for recreational activity, mostly fishing. The Mill now operates by electricity.

g. Design and Construction: Spillways

The only data available to determine the date of construction were our visual evaluation and inspection. The dams appear to have been constructed within the last sixty years. No design data are available. The original

purpose of dam construction was to divert water to the mill to operate water-powered turbines. These turbines are no longer in use.

Modifications (within the past fifteen years) to both the earth embankments and the Mill Road Dam are evidenced by the installation of new sheet piling and concrete slope protection between upper and lower wingwalls. It appears that the purpose of the slope protection is to provide stability to the base of the upper wingwall, thus preventing both vertical and horizontal rotation of that wall. Furthermore, the slope protection reduces erosion resulting from high velocity water exiting from the culvert. In conversations with Mrs. Doris Brown, the leasee living in the closest downstream house on the dam embankment, it was noted that fill had been placed along the downstream embankment filling several washouts which had occurred from flooding within the last 10 years.

h. Normal Procedures

The dam is controlled by the owner's agent, a relative living in Wyoming, Delaware. The potential for flooding is checked and is determined by local police before and during times of rainfall. The agent contacts a local service station to operate the stoplogs via the use of a tow truck since the stoplogs cannot be hand lifted or lifted by use of a prybar. According to local witnesses, overtopping the dam can be avoided by timely opening of the stoplogs.

2.3 PERTINENT DATA

a. Drainage Area - 11.08 square miles.

b. Discharge at Damsite - Maximum known flood at damsite is unknown. Water has overtopped dam within past 10 years.

Warm water outlet at pool elevation:	None
Diversion tunnel low pool outlet at pool elevation:	Mill Race Dam
Diversion tunnel outlet at pool elevation:	None
Gated spillway capacity at pool elevation:	N/A
Gated spillway capacities at maximum pool elevation:	N/A
Ungated spillway capacity at maximum pool elevation:	1900 CFS
Total spillway capacity at maximum pool elevation:	1900 CFS
Total spillway capacity @ top of dam:	220 CFS

c. Elevation: (Feet above Mean Sea Level [M.S.L.])

Top Dam:	Main Dam Elev. - 32.81 MSL ±
	Mill Race Elev. - 31.61 MSL ±
	Average Crest Elev. - 32.50 MSL ±
Maximum Pool Design Surcharge:	34.05 MSL
Full flood control pool:	31.61 MSL
Normal pool:	Elev. 29.0 MSL ±
Spillway Crest (gated):	Elev. 29.0 MSL ±
Upstream portal invert diversion tunnel:	N/A
Downstream portal invert diversion tunnel:	N/A
Streambed at centerline of dam:	Elev. 20 MSL ±
Maximum tailwater:	Tailwater at high stream discharge probably will be controlled by a culvert under Rt. 195 and the bridge thru the railroad embankment.

d. Reservoir

Length of Maximum Pool:	8000 feet
Length of Normal Pool:	2100 feet
Length of Flood Control Pool:	N/A

e. Storage (Acre-feet)

Normal Pool:	165 A.F.
Flood Control Pool:	N/A

Top of Dam:	669 A.F.
Design Surcharge: Peak 100 year figure for volume	768 A.F.

f. Reservoir Surface (Acres)

Normal Pool:	96.4 AC
Top of Dam:	214 AC
Flood Control Pool:	N/A
Maximum Pool:	214 AC
Recreational Pool:	N/A

g. Dam

Type: Earth embankment with two concrete box culverts. Spillways controlled by lift gates (inlet side).

Length: 600+ feet of earth embankment - 17 feet of concrete/ wood overflow (spillway)

Height: Existing embankment and earth fill - 12 feet.

Top Width: Earth embankment 12 feet to 250 feet in width. At bridge abutments 12 feet, widening to 250 feet at northern and southern extremeties. Average width approximately 25 feet.

Side Slopes: Southern side (earth fill) 1:5 @ pool. Approximately 3:1 downstream below normal pool.

Northeastern Side: Earth fill approximately 3:1 @ pool; 2:1 downstream.

Zoning:

Impervious Core:	Unknown
Cutoff:	Unknown - Steel sheet piling @ downstream embankment each side of culvert may act as cutoff.
Grout Curtain:	Unknown

h. Diversion and Regulating Tunnel

Type: Mill Race

Length: 70'

Closure: Wood Slide Gates (Stoplogs)

Access: Single box culvert gated with stoplogs attached to lifting shaft - three 2.5 foot gated inlets 4 to 5 feet high.

Regulating Facilities: Not in operation - current regulating device one 42" round pipe beneath mill.

i. Spillway

Type: Double box concrete culvert with gated inlets comprised of stoplog gates attached to lifting shaft - four 2.3 foot wide inlets, 10 feet high; one not operable

Length of Weir: 9.2 feet

Crest Elevation: Elevation 29 feet M.S.L. (average)

Gates: 4 wood stoplog lift gated spillways.

U/S Channel: None

D/S Channel: Box culvert discharges to mitered concrete exit channel 12 feet long by 10 feet wide followed by earth embankment. Channel with low sloping densly vegetated sides 150' to Route 195 culvert.

j. Regulating Outlets

Type: None

Length: N/A

Closure: N/A

Access: N/A

SECTION 2 - ENGINEERING

2.1 ENGINEERING DATA

a. Design

No drawings were available regarding design and construction of the Wyoming Lake Dam. Various as-built drawings have been prepared by our office and are included in the Appendix.

The Delaware Department of Transportation, Division of Highways, provided two drawings of the Route 195 culvert. These drawings are denoted as Plate No. 6 and Plate No. 7.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General

The dam and its appurtenant structures were found to be in poor to fair overall condition at the time of inspection. The problems noted during inspection were not considered severe and do not require immediate remedial treatment. Noteworthy deficiencies observed are described briefly in the following paragraphs. The complete visual inspection check list is given in Appendix A.

b. Dam

Embankment

No visual evidence of leakage or seepage was observed at the time of inspection. At each side of the bridge abutment there is slight surface erosion occurring as a result of road surface run-off on the downstream side of each embankment. Several 10 to 18 inch diameter willow trees were growing on the upstream side of the embankment near the north end of the main spillway bridge structure.

c. Appurtenant Structures

Spillway Bridge (Culvert)

The condition of the abutment walls, bridge deck, and wingwalls is fair. There is no significant cracking and only minor concrete surface spalling. The center bridge support wall shows some signs of concrete deterioration at the base. The downstream bridge wingwalls have tilted some time in the past. This was probably caused by erosion of the embankments or from turbulance from water exiting at the box culvert outlet. This wingwall condition has been stabilized by the installation of steel sheet piling, tieback rods and concrete slope protection. Since the installation of the sheet piling on the north side of the spillway, the

sheeting has tilted outward approximately 6 inches at the top; thus, indicating a tieback rod failure. In spite of this condition, the sheet piling and wingwall appear to be stable at this time.

The condition of the stoplogs is poor. Of the four stoplogs, one lift bar is broken and some stoplogs have been patched by nailing plywood sheeting to the lift bar. Considerable spalling has occurred on the stoplog supporting concrete piers. The recessed guide grooves are badly deteriorated.

The timber trash rack structure on the upstream side of the spillway has deteriorated beyond repair and at present serves no purpose.

Mill Race & Turbine Structure Approach

The south concrete approach wall to the Mill Race shows signs of minor concrete deterioration. The 2 to 3 foot high retaining wall on the north bank has tilted inward approximately 2 inches and stabilized. The concrete piers that support the metal storage building which spans the approach to the race shows signs of minor concrete deterioration at and below the water line. The entrance to the gates utilizes a trash rack which is presently filled with miscellaneous debris. The one inch diameter trash rack rods are badly deteriorated to approximately 1/2" diameter at the water line, and the rack is clogged with debris. The wood stoplogs are in very poor condition and may be inoperable. The Mill Race concrete culvert shows signs of minor concrete deterioration but no significant cracking was evident. The water distribution chamber upstream of the turbines is in fair condition.

Within the Mill the south turbine chamber has been closed and is not accessible for inspection. The north turbine chamber is open. Inspection revealed that the stone foundation wall that separated the two chambers has practically collapsed and is potentially unstable. Neither turbine is operable.

Mill Building

The overall condition of the Mill Building is poor to fair. The partially collapsed foundation wall that divides the turbine chambers also supports part of the Mill floor. At the upstream side of the Mill Building is an access ramp down to the basement. This ramp causes the basement to be susceptible to filling with water should the lake overtop the dam in this area.

d. Reservoir Area

No serious deficiencies were observed in the reservoir area. Some minor erosion and sedimentation has occurred at several locations along the lake shore. However, the erosion and sedimentation do not require remedial measures.

e. Downstream Channel

No major deficiencies were observed in the downstream channels at either the main chamber or the Mill Race channel.

f. Downstream Structures

The highway structure at Route 195 appeared in good condition and has been reconstructed within the past five years. The railroad structure appeared in fair to good condition. Below the railroad bridge the steel beam highway bridge, supported on concrete abutments, appeared to be in fair to good condition.

3.2 EVALUATION

The need for repair of the stoplogs is discussed in Section 7.

The condition of the trash rack structure on the upstream side of the spillway structure is discussed in Section 7.

The need to clean debris from the Mill Race trash rack is discussed in Section 7.

The need to repair the deteriorating foundation wall separating the north and south turbine chamber is discussed in Section 7.

The effect of the Willow trees located on the upstream side of the embankment on the north end of the main spillway bridge structure is discussed in Section 7.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

Wyoming Lake Dam is operated by Boyd's Wrecking Service, who is contacted by the local police department in the event of potential flood. The lake level is controlled by the relatively fixed position of the top of the stoplogs at the main spillway and by lifting the stoplogs at the Mill Raceway. When significant rainfall is anticipated, the stoplogs are lifted by a towtruck, as other manual operation appears impossible.

4.2 MAINTENANCE OF DAM

Modifications to the dam have been implemented in the past, but no formal or systematic program currently exists. Based upon conversations with Mrs. Brown, leasee of the dwelling, the Owner of the Mill repaired the eroded embankment and widened the crest of the embankment near the dwelling approximately 10 years ago. Visual examination of the downstream wingwalls of the main spillway reveals modification by driving sheet piling and placing concrete slope protection between wingwalls.

4.3 MAINTENANCE OF OPERATING FACILITIES

The stems connecting the stoplogs regulating the discharge appear not to have had any serious corrective repair for some time. One of the gates is completely inoperable since additional boards have been nailed to the stem which precludes the gate's removal. After assessing the storm condition, Boyd's Wrecking Service regulates the stoplogs.

4.4 DESCRIPTION OF A WARNING SYSTEM IN EFFECT

The Township Police patrol the area and observe the lake during storm warning periods. They are apparently in contact with the Owner's agent who effectuates the operation of the control system described in section 4.1

4.5 EVALUATION

1. The need for implementation of annual inspections will be discussed in Section 7.

2. The need for keeping records of construction improvements will be discussed in Section 7.

3. The need for implementation of a warning system will be discussed in Section 7.

SECTION 5 - EVALUATION OF HYDROLOGIC AND HYDRAULIC FEATURES

5.1 EVALUATION OF FEATURES

a. Design Data

No design data were available for either the hydrology of the watershed or the capacity of the spillway. For hydrologic evaluation, watershed parameters measured from U.S.G.S. 7.5' quadrangles were used with Snyder coefficients and loss rates specified by the Philadelphia District Corps of Engineers, to compute peak inflows to the reservoir. The HEC-1 DB computer program was used to compute inflow hydrograph and route water through the reservoir.

The dimensions of the dam and the spillway were obtained from a field survey. Spillway capacity was calculated from this survey information by standard engineering methods. The relevant data for the highway culverts and the railroad bridge downstream were also measured since these structures are restrictions to flow which would control the tailwater at the dam.

Based on the size and hazard potential classification for this dam, the recommended spillway design flood range is 100 years - 1/2 PMF. For evaluating the adequacy of the spillway, the 100 year flood was used as the SDF.

b. Experience Data

No measurements of outflows from the dam or flows within the watershed of the dam are available. However, overtopping the dam has occurred in the past, resulting in minor soil erosion adjacent to the property situate on the embankment.

c. Overtopping Potential

From the HEC-1 DB program the peak SDF (100 year) inflow = 2676 CFS. The water level in the reservoir would have to reach elevation 34.05 with a

peak outflow of 2334 CFS to pass the Spillway Design Flood. This would overtop the dam by 1.55 feet. The spillway capacity at the top of dam elevation (32.50) is 220 CFS, which is equal to 9.5% of the SDF peak outflow. A rating curve for the spillway and a graph summarizing peak inflows and outflows is included in Appendix D.

d. Reservoir Drawdown

There exists no consistantly reliable method for removal of the spillway stoplogs without the use of an outside contractor with a winch lifting device. Our conclusion is that this is not an effective method for emergency drawdown. Therefore, emergency drawdown calculations are irrelevant.

SECTION 6 - STRUCTURAL STABILITY

6.1

a. Visual Observations

Except for the center wall beneath the Mill, no significant structural inadequacies were noted during the inspection of the dam. As noted in our report, some slight cracking of the downstream north wingwall of the Mill Road Dam structure and general deterioration of the dams was evidenced. It does not appear that the cracking nor the deterioration pose a structural threat at this time. However, these conditions must be repaired to prevent further deterioration.

b. Design and Construction Data

Stability calculations for the dam do not exist. Insufficient engineering data are available to make an accurate independent assessment of the earth-fill embankment. Neither accurate engineering drawings nor computations are available. However, general experience with slopes, crese elevations, structures, materials and hydraulic conditions similar to those which appear at this dam, indicates that these slope conditions could satisfy the stability requirements of the "Recommended Guidelines For Safety Inspection of Dams". Furthermore, this inference is supported by empirical guidelines for recommended slopes for small homogeneous earthfill dams provided by the U.S. Bureau of Reclamation (1965) Design of Small Dams, First Edition, Page 199. The modest height and slopes of the dam and the fact that no indications of instability were observed during the inspections are indicative that no further stability assessments are necessary.

Insufficient engineering data is available to make an accurate independent assessment of the concrete bridge (culvert) with gated spillway. However, no physical defects were noted that would indicate a potential structural stability inadequacy.

c. Operating Records

Operating records have not been kept for Wyoming Lake Dam.

d. Post-Construction Changes

Modifications to the western side wingwalls on the downstream side of the Mill Road Bridge are evident. It was also noted that stone and broken bituminous materials (construction debris) had been added to the slopes downstream to stabilize the bank from surface erosion.

e. Seismic Stability

Wyoming Lake Dam is located in Zone 1 on the Seismic Zone Map of the United States. Experience has shown that structures having adequate stability under static loading conditions will also have adequate stability during seismic activity. Therefore, that portion of the dam noted in this report as being stable under static loading conditions is considered stable during seismic activity.

SECTION 7 - ASSESSMENT & REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety

The dam has been inspected visually in accordance with procedures stipulated by the Corps of Engineers for a Phase I Report. Since no engineering data were available for review, our assessment is subject to the limitations inherent in a visual inspection for a Phase I Report.

- The wall dividing the Mill Race downstream is considered structurally inadequate. Significant deterioration of the mortar bonding the stone together was noted during inspection. Without this mortar the stone is held together by friction and this is of small structural value. Collapse of this wall would impose a restriction to flow which could possibly cause damage to the Mill.

- Some patchwork and considerable repair was noted on the stoplogs of the spillway. Plywood patches infrequently nailed were noted. The patchwork does not appear to be increasing the structural integrity of the stoplogs, which have deteriorated with time.

- Several 10 to 18 inch diameter willow trees growing on the upstream side of the embankment near the north end of the main spillway bridge structure were noted. Overturning of these trees due to wind with resultant pull-out of roots could seriously damage the dam.

- Large amounts of debris were noted in the trash rack structure located on the upstream side of the spillway and in the Mill Race itself. The trash rack, if left

unattended, obstructs flow, increasing tailwater elevation at the dam and, in effect, could become a dam in itself with a dangerously small spillway.

- No seepage or slope failures were noted during inspection that would indicate potential piping or embankment failures. According to the owner, no seepage or slope failures have occurred in the past. It should be noted, however, that although no signs of piping were noted, at the location of the willow trees, the potential for piping does exist in this area.

- The spillway has a hydraulic capacity equal to 9½% of the peak SDF outflow. The low point of the dam will be overtopped by 1.55 feet.

- Warning System - Although no formal warning system is in effect, the need for a system is not considered necessary since there are no homes immediatley downstream and only one on the dam. Teh people occupying the house located on the embankment portion of the dam would be able to spot danger immediately without a warning.

- An annual inspection is needed in order to enable the owner to notice variations of specific portions of the dam.

- Accurate construction records should be kept during modifications or alterations to the dam. This information is needed to enable accurate analysis in the future.

b. Adequacy of Information

No additional information is necessary for an assessment of the safety of Wyoming Lake Dam.

c. Urgency

A further study should be indicated in the future to study the feasibility of increasing the hydraulic capacity of the spillway.

- The willow trees should be reduced in height, such that at all times, a maximum height of five feet is maintained. This action should be initiated soon.

- The deteriorated stone wall dividing the Mill Race downstream should be repaired or replaced in the near future.

- The deteriorated/patched stoplogs should be replaced in the near future.

- The deteriorated trash racks located at the Mill Race and the Mill Road spillway should be repaired or replaced in the future but cleaned of all debris soon.

d. Necessity of Additional Data/Evaluation

As noted in Section 7.1 A and B, no additional data or evaluation is necessary to assess the safety of the dam.

7.2 REMEDIAL MEASURES

a. Alternatives

Provide lifting gates with geared mechanism to lift by hand or crank or motor operator.

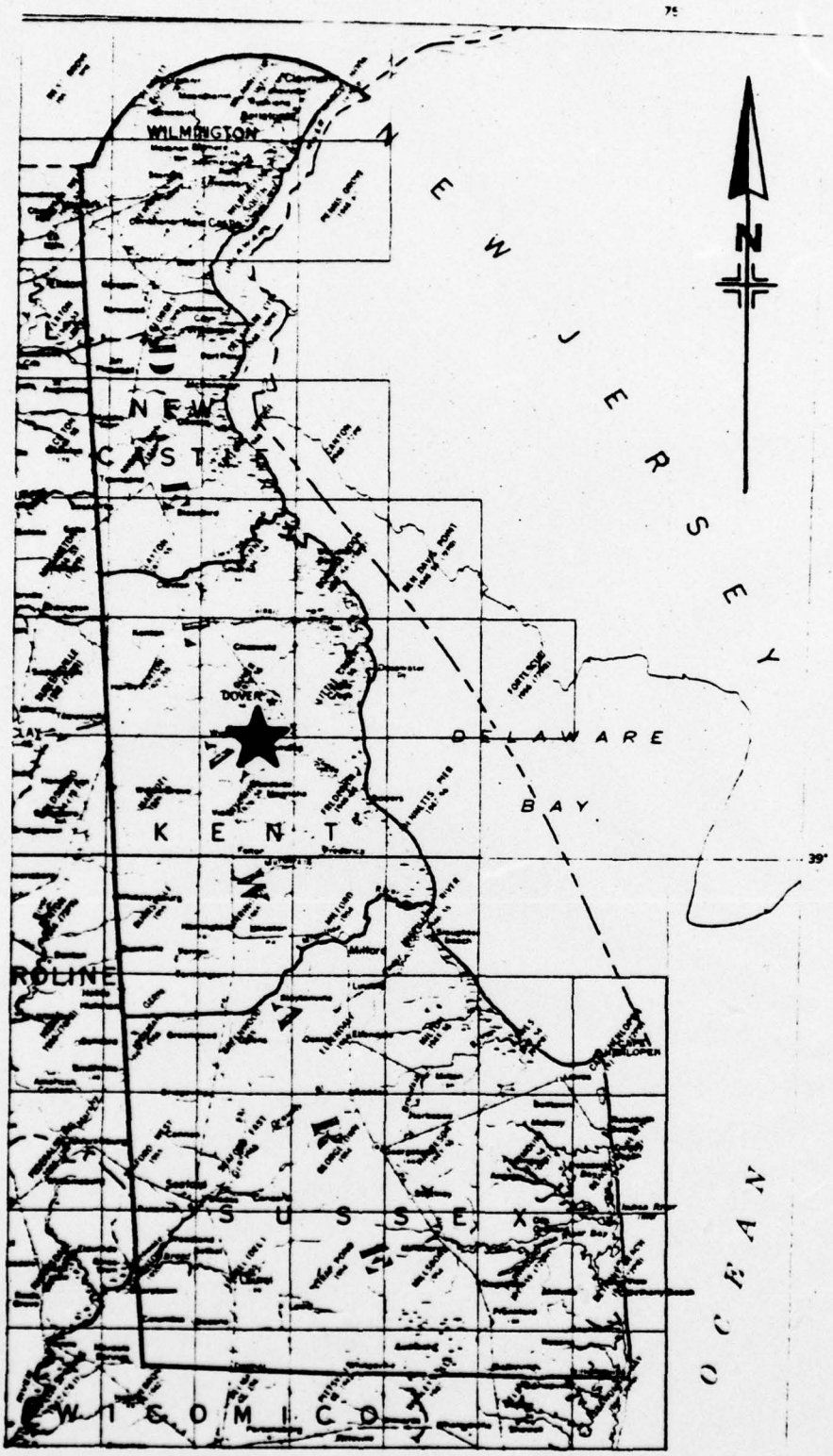
b. O & M Maintenance Procedures

An annual inspection visit should be initiated using a visual check list similar to the one enclosed in this report.

All drawings and computations relating to repair, renovation and

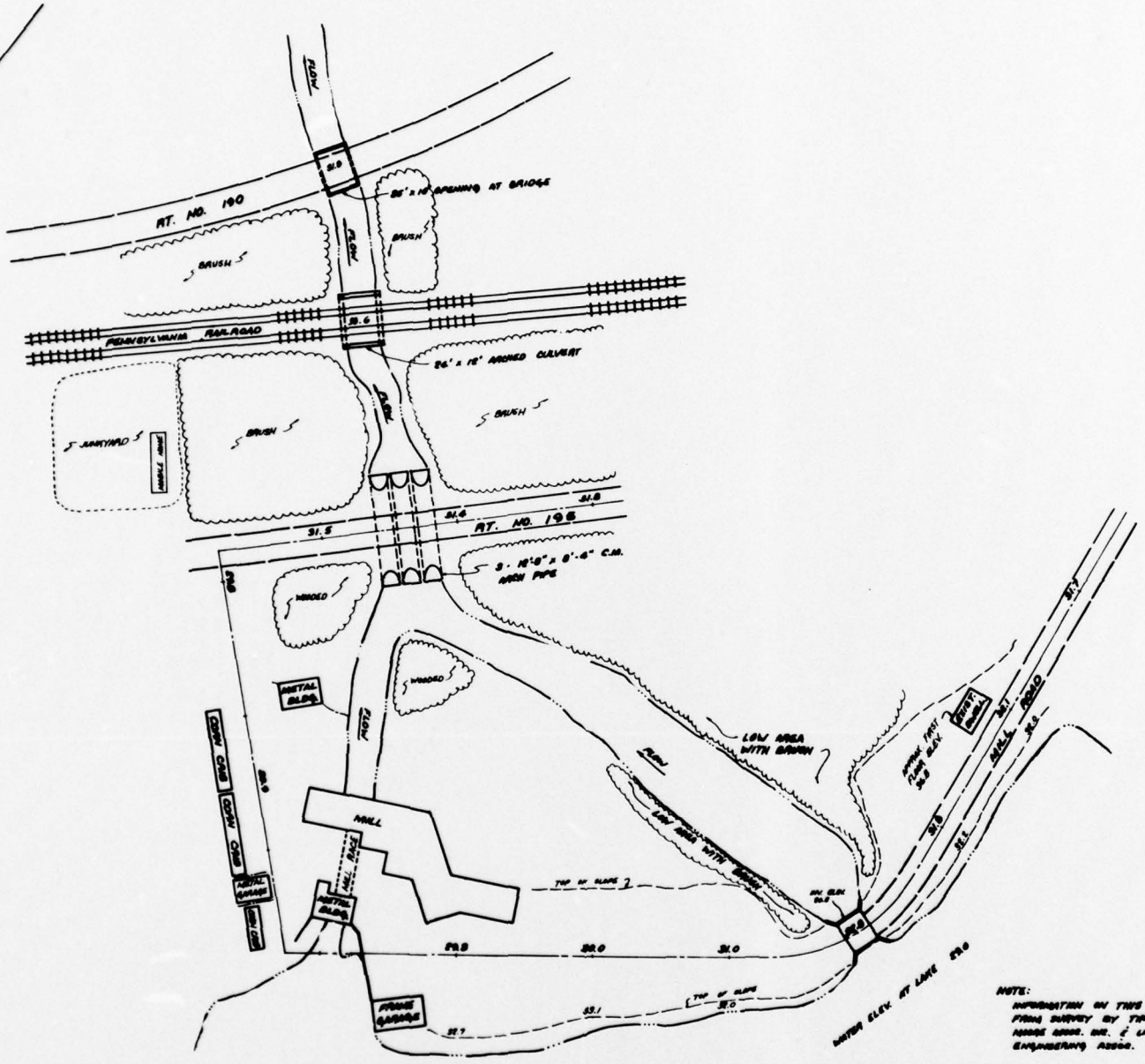
maintenance of the dam should be kept as a matter of record. All visits to the dam for operation and maintenance should be logged in as a matter of record.

Plates



LOCATION MAP

WYOMING LAKE DAM



NOTE:
INFORMATION ON THIS PLAN TAKEN FROM SURVEY BY THOMAS TYLER ASSOC. DEL. & LIPPINCOTT ENGINEERING ASSOC.

NO	DATE	REVISION	DRN	CHK

DRN ____ CHK ____ APP ____ SCALE ____ DATE 2-10-70

LIPPINCOTT ENGINEERING ASSOCIATES
CONSULTING ENGINEERS
501 BURLINGTON AVE. DELANCO, NEW JERSEY 08075

LEA

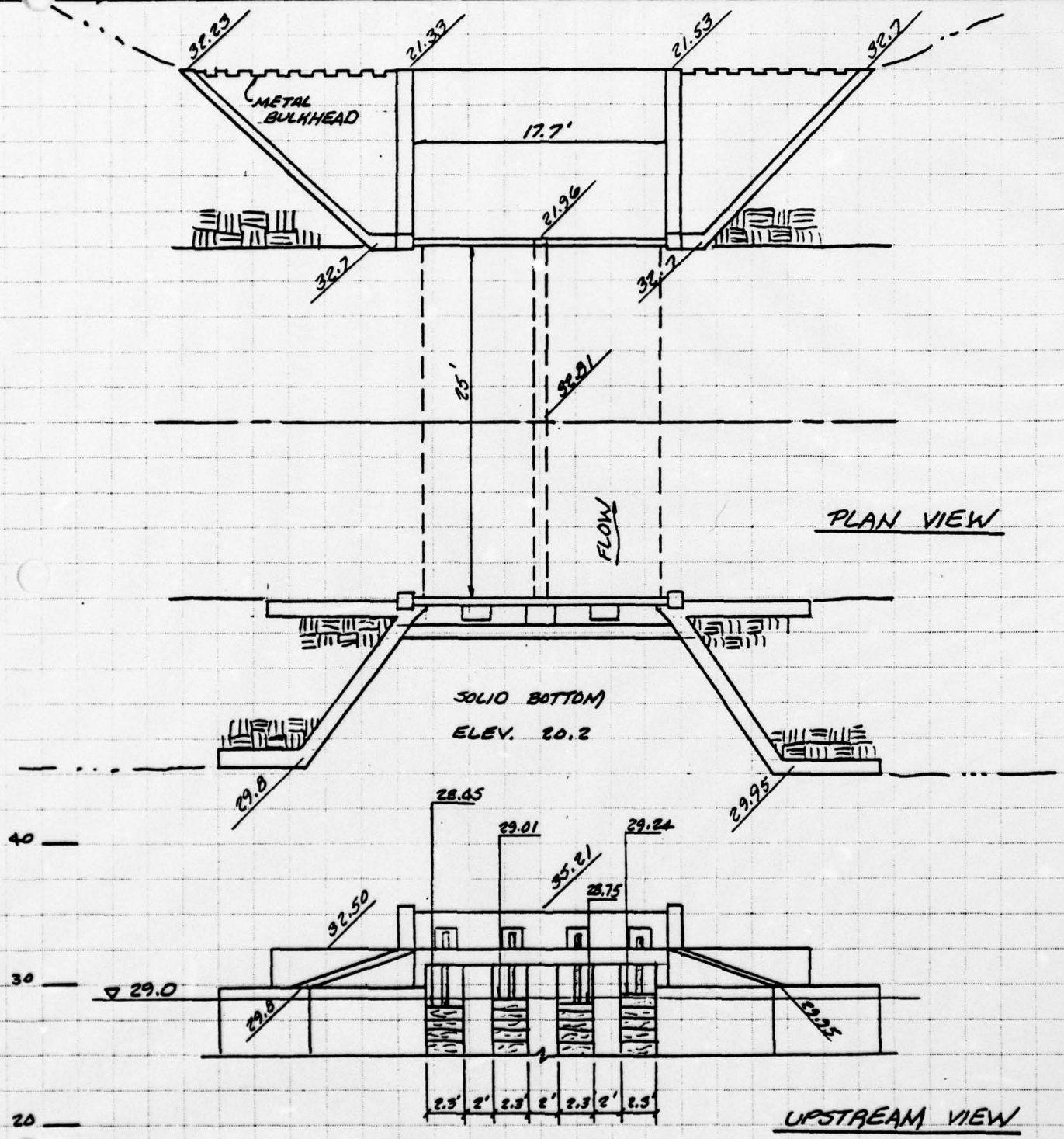
LOCATION PLAN
WYOMING LAKE DAM
WYOMING KENT COUNTY
DELAWARE

JOB NO. 2069 DRAWING NO. ____

Lippincott Engineering Associates
501 Burlington Avenue
DELANCO, NEW JERSEY 08075
Area Code (609) 461-1239

SHEET NO. 3 OF
CALCULATED BY GMW DATE 2/79
CHECKED BY DATE
SCALE 1" = 10'

RIDGE AT MILL ROAD



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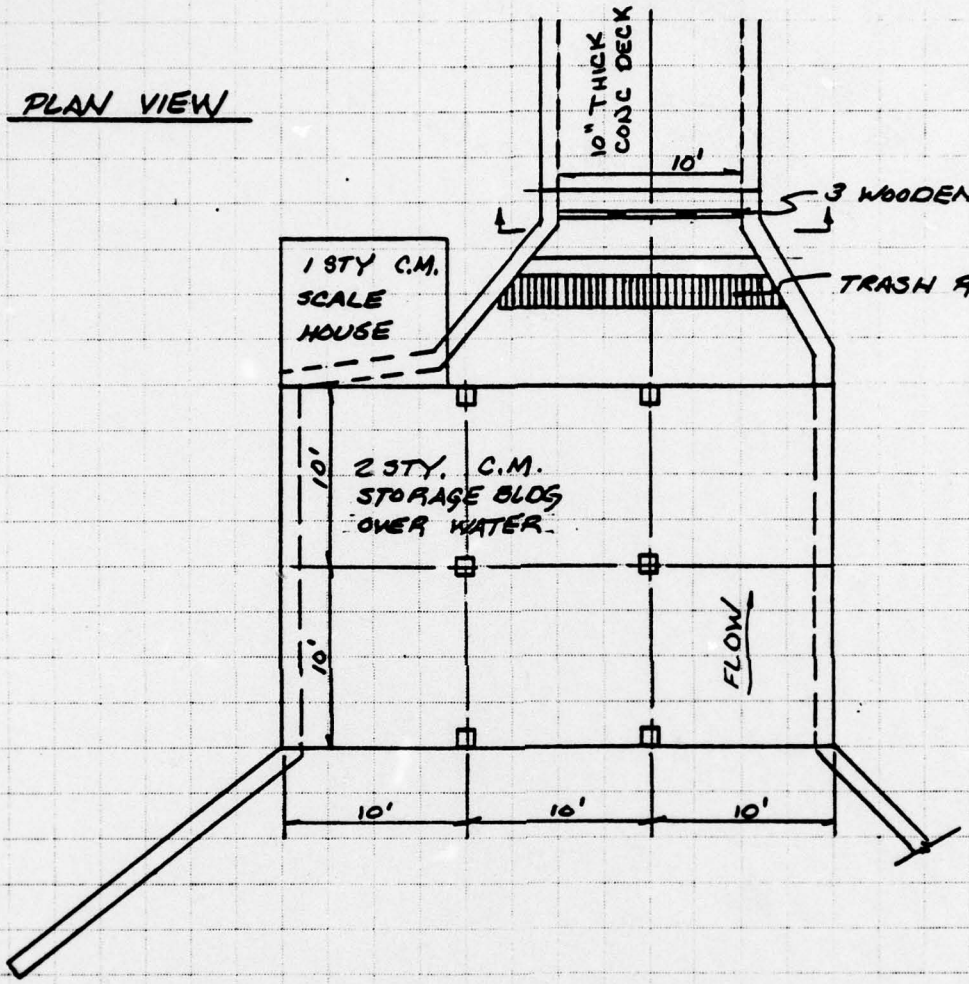
Area Code (609) 461-1239

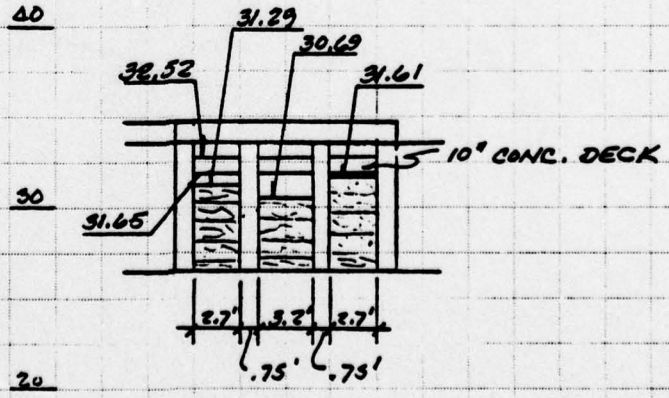
SHEET NO. 4 OF
CALCULATED BY GMW DATE 2/79
CHECKED BY DATE
SCALE 1" = 10'

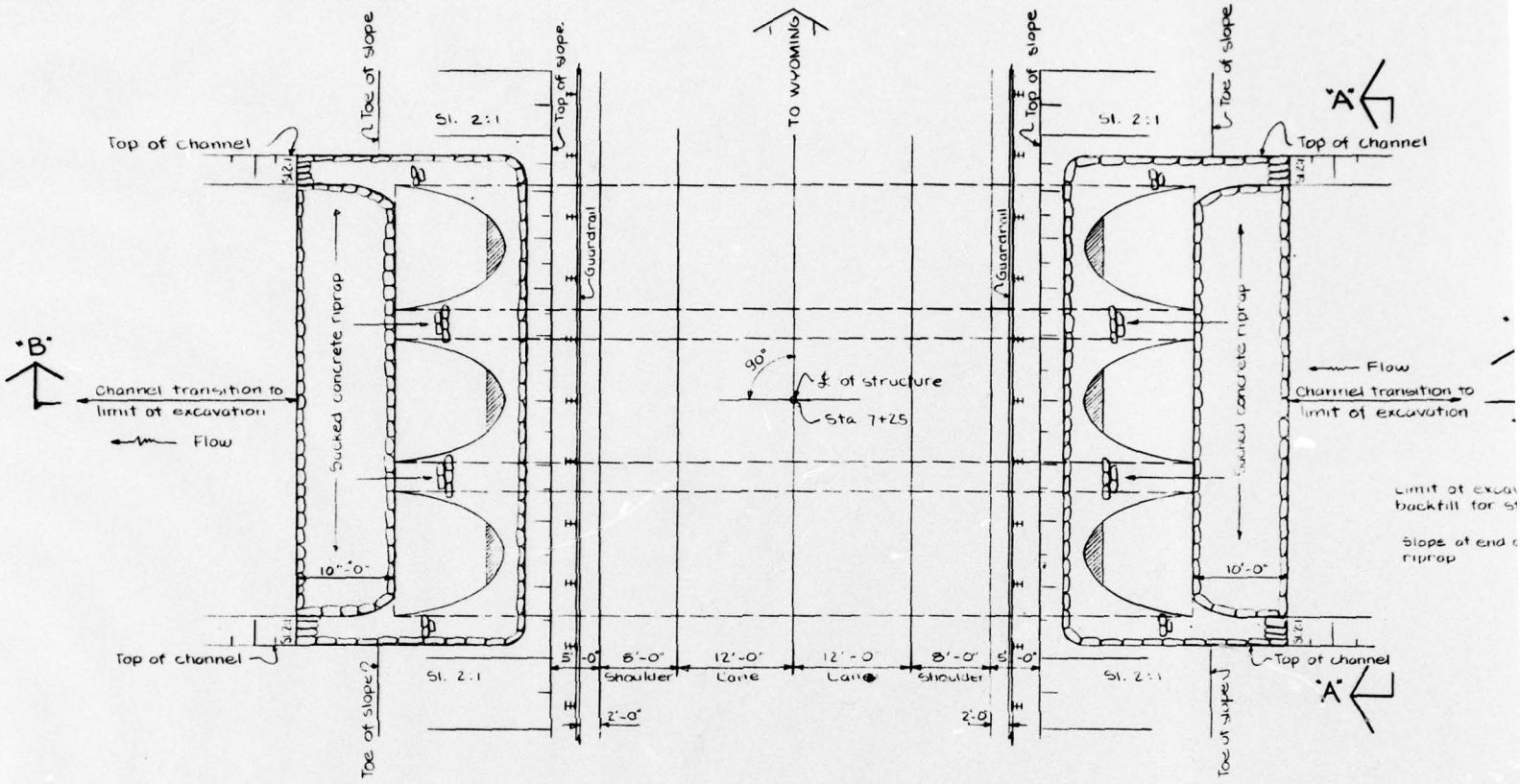
MILL RACE

PLAN VIEW

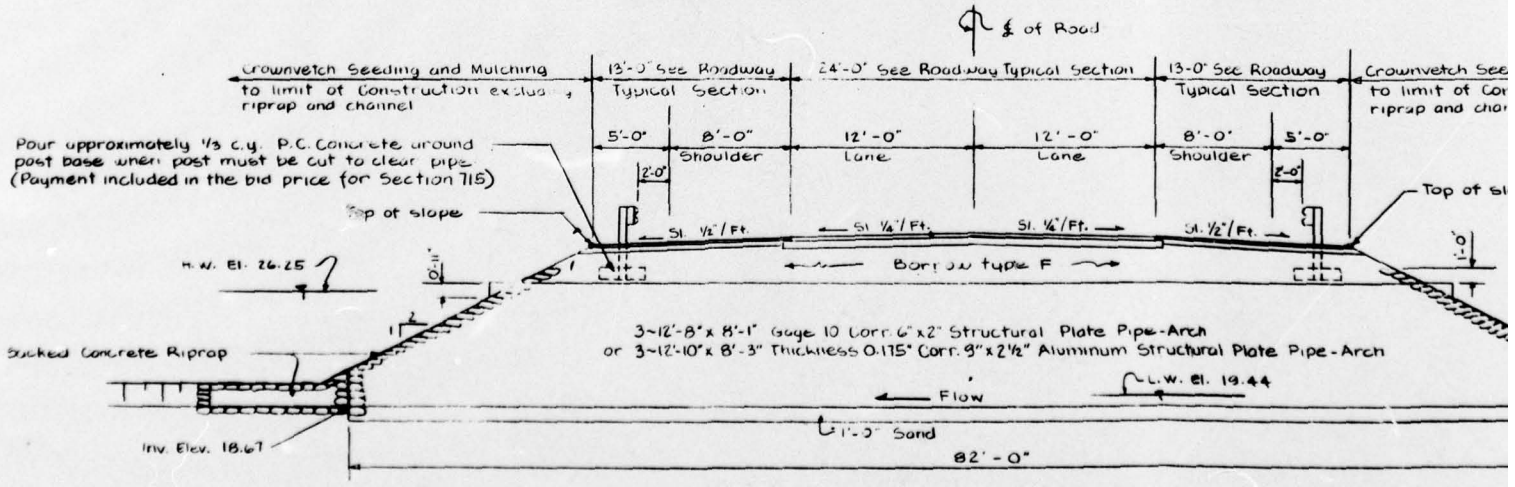


SECTION CONTROL GATES





P L A N
SCALE 1/8"=1'-0"



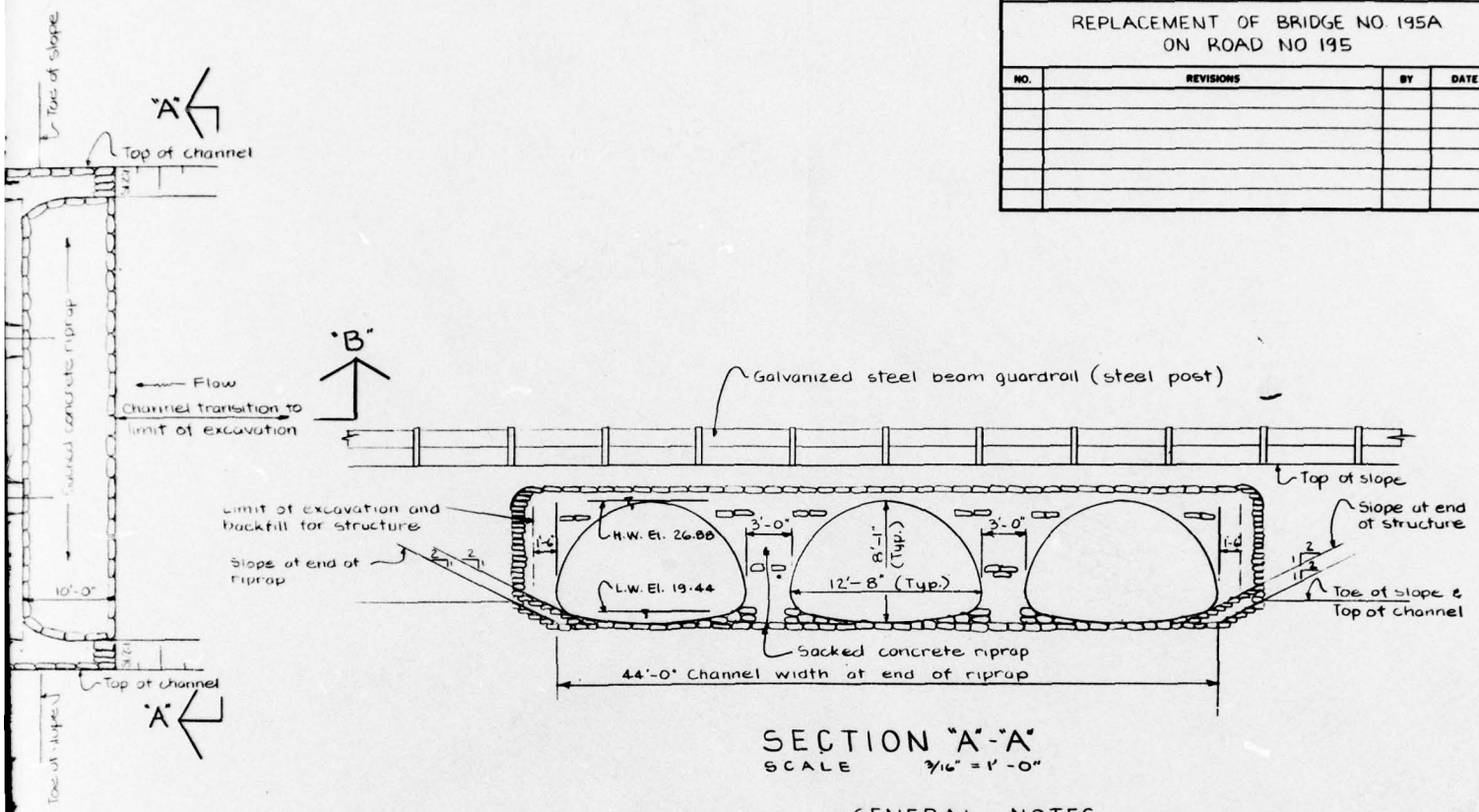
SECTION "B"-"B"
SCALE 3/16"=1'-0"

1

COUNTY	CONTRACT	F. A. P. ROU. NO.	STATE	FED. AID PROJECT NO.	SHEET NO.	TOTAL SHEETS
KENT	74-12-008	2	DEL	BS-20(2)	3	11

REPLACEMENT OF BRIDGE NO. 195A
ON ROAD NO 195

NO.	REVISIONS	BY	DATE



SECTION "A"-"A"
SCALE 3/16" = 1'-0"

GENERAL NOTES

LOCATION: The replacement of Bridge No. 195A is located on Road No. 195, Kent County.

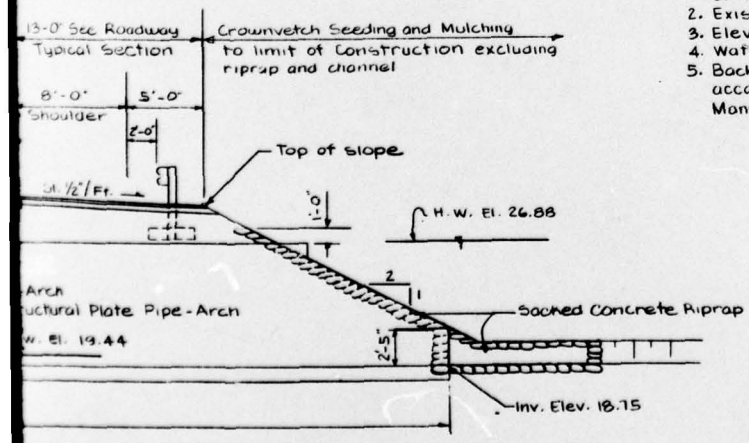
DESIGN CRITERIA: AASHO Standard Specifications for Highway Bridges 1973, with current AASHTO Interim Specifications 1974 and 1975.

LOADING: HS-20-44

SPECIFICATIONS: Materials and Workmanship shall conform to the Standard Specifications of Delaware Department of Highways and Transportation dated January 1, 1974, unless otherwise noted and specified in the Special Provisions.

GENERAL:

1. CLEARING and GRUBBING: Do not removed any trees and vegetation unless absolutely necessary for construction.
2. Existing structure shall be removed completely.
3. Elevations are based on U.S.C. & G.S. datum.
4. Watch for existing utilities.
5. Backfilling shall be done simultaneously on all sides of the arch and in accordance with Article 2.23.9 of AASHO Specifications of 1973, and Manufacturer's requirements as approved by the Engineer.

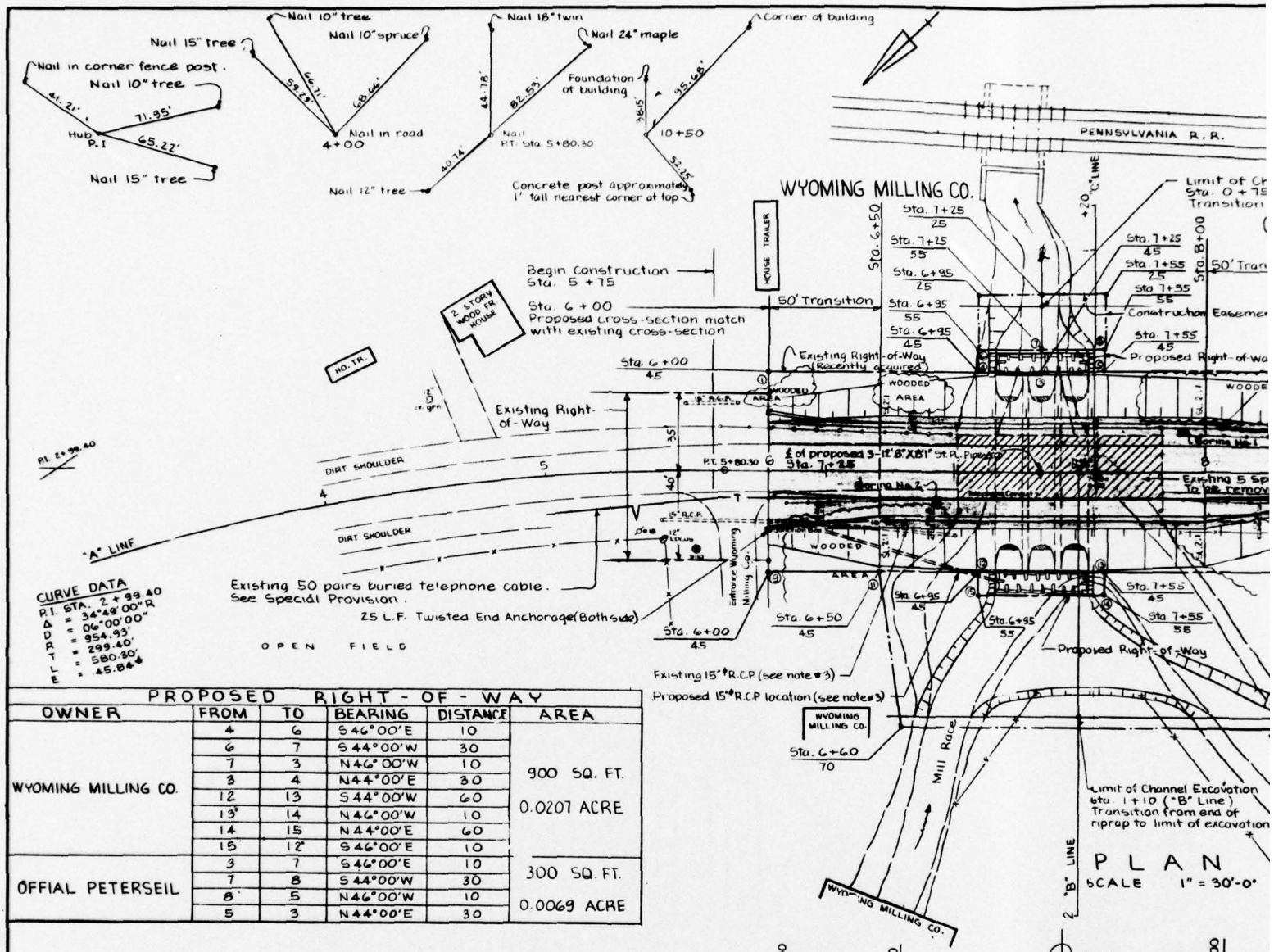


DELAWARE
DEPARTMENT OF HIGHWAYS & TRANSPORTATION
DIVISION OF HIGHWAYS

PLAN and SECTIONS

		SCALE	APPROVED BY:
D.	F.B.B.	As Shown	
T.	F.B.B.		BRIDGE ENGINEER
C.	K.G.P.		

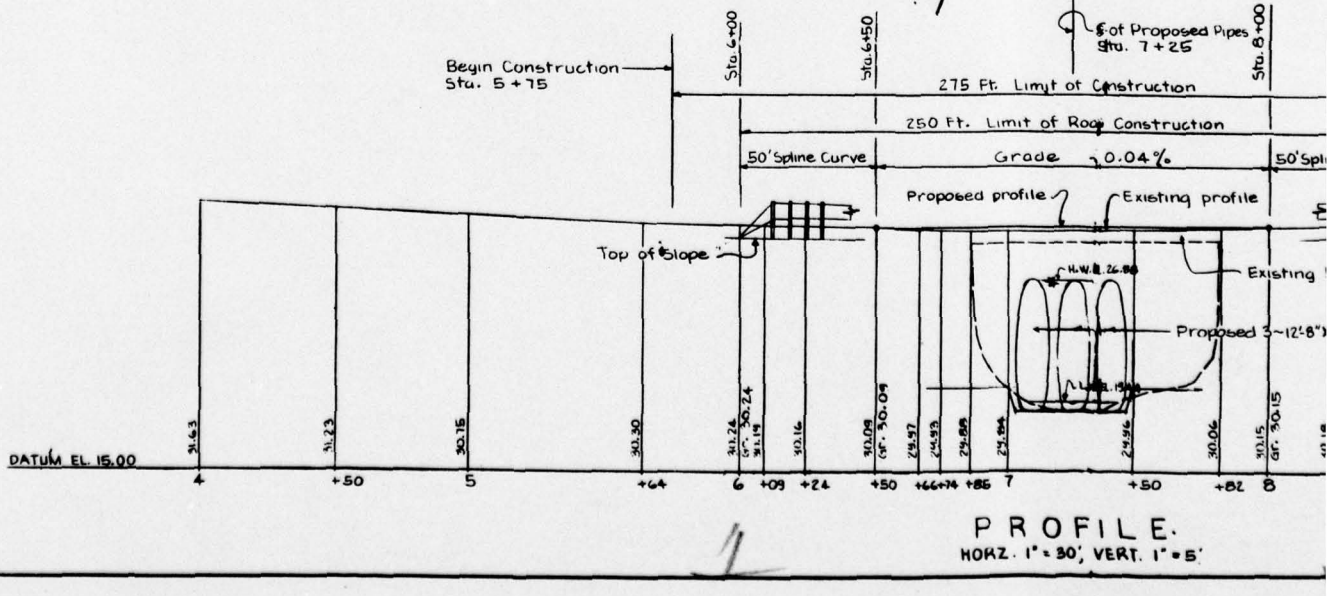
1 1 2



CURVE DATA
P.I. STA. 2+99.40
Δ = 34°48'00" R
D = 06°00'00"
R = 954.93'
T = 299.40'
L = 580.30'
E = 45.84'

PROPOSED RIGHT-OF-WAY

OWNER	FROM	TO	BEARING	DISTANCE	AREA
WYOMING MILLING CO.	4	6	S 46°00'E	10	900 SQ. FT. 0.0207 ACRE
	6	7	S 44°00'W	30	
	7	3	N 46°00'W	10	
	3	4	N 44°00'E	30	
	12	13	S 44°00'W	60	
	13	14	N 46°00'W	10	
	14	15	N 44°00'E	60	
	15	12	S 46°00'E	10	
OFFIAL PETERSEIL	3	7	S 46°00'E	10	300 SQ. FT. 0.0069 ACRE
	7	8	S 44°00'W	30	
	8	5	N 46°00'W	10	
	5	3	N 44°00'E	30	



PROFILE.
HORZ. 1" = 30', VERT. 1" = 5'

BENCH MARK NO. 2: Nail in piling
Sta. 7+82, 21' Lt. El. 25.907

COUNTY	CONTRACT	P. S. & P. PROJ. NO.	STATE	FED. AID PROJECT NO.	SHEET NO.	TOTAL SHEETS
KENT	74-12-008	2	DEL	RS-20(2)	2	11

REPLACEMENT OF BRIDGE NO. 195A
ON ROAD NO. 195

NO.	REVISIONS	BY	DATE

PRINTED
SEP 20 1978
ROAD DESIGN SECTION
DELAWARE STATE HIGHWAY DEPT.

PENNSYLVANIA R.R.

Limit of Channel Excavation
Sta. 0+75 ("C" Line)
Transition from end of riprap to limit of excavation

OFFIAL PETERSEIL

Sta. 7+25
45
Sta. 7+55
25
Sta. 7+55
55
Construction Easement
Sta. 7+55
45
Proposed Right-of-Way

Sta. 8+00
50' Transition

End. of Construction
Sta. 8 + 50
Proposed cross-section match with existing cross-section

225 L. F. of Galv. Steel Beam Guardrail to be connected to existing guardrail. (Both sides)

Sta. 8+50
45

WOODED AREA

TAR & CHIP

Existing 5 Span Timber Bridge To be removed

S44°00'00"W → 10

TO WYOMING

WOODED AREA

Existing Right-of-Way

Sta. 8+50
45

Existing Right-of-Way (Recently acquired)
Construction Easement

Sta. 7+55
45
Sta 7+55
55
Proposed Right-of-Way

WYOMING MILLING CO.

Sta. 8+50
10

Crownvetch Seeding & Mulching to limit of construction

Limit of Channel Excavation
Sta. 1+10 ("B" Line)
Transition from end of riprap to limit of excavation

Isaac Branch

"B" LINE

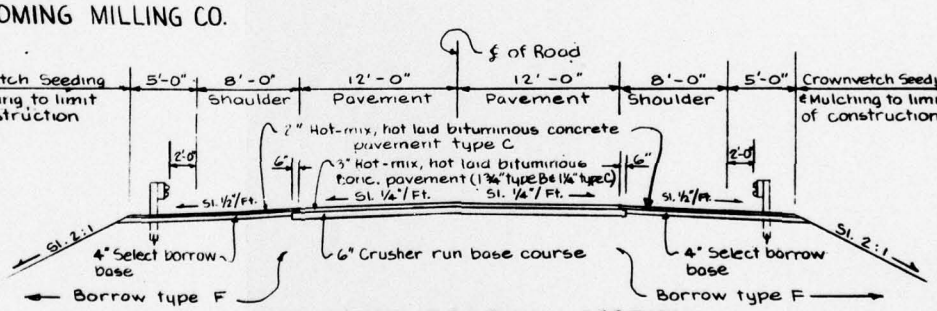
PLAN
SCALE 1" = 30'-0"

LEGEND

Hot-Mix Bituminous Conc.
Existing Bridge
Existing Right-of-way
Proposed Right-of-way
Construction Easement

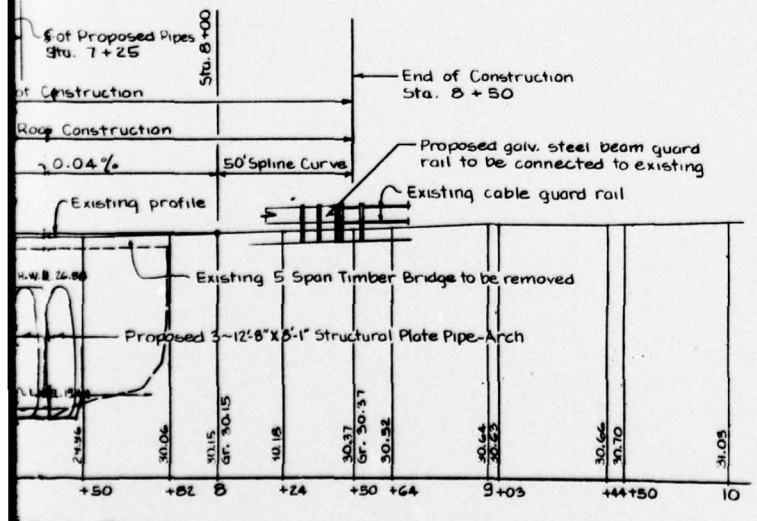
HYDRAULIC DATA:

Drainage Area	=	7,223 Acres
Design Frequency	=	50 Years
Estimated Runoff	=	920 cfs
Estimated Velocity	=	3.80 fps



TYPICAL ROADWAY SECTION
NOT TO SCALE

NOTES:
1. At flood stages water elevation was controlled by the bridge downstream, Bridge No. 190 B on Road No. 190 and R.R. Bridge (Pennsylvania R.R.).
2. Remove all C.M.P. and cable guard rails within the limit of construction and payment shall be included in the bid price of Section 201.
3. Existing 15"ø R.C.P. shall be relocated as shown on plans, match outlet elevation with bottom of channel or as directed in the field. Any damage pipe shall be replaced. Replacement and additional pipes shall be included in the bid price of Section 210.



FILE.
0', VERT. 1"=5'

Wyoming Lake

DELAWARE
DEPARTMENT OF HIGHWAYS & TRANSPORTATION
DIVISION OF HIGHWAYS

PLAN, PROFILE, SECTION and RIGHT-OF-WAY PLAN

D. F.B.B.	SCALE	APPROVED BY:
T. F.B.B.	As Shown	
C. K.G.P.		BRIDGE ENGINEER

2

Lippincott Engineering Associates
501 Burlington Avenue
DELANCO, NEW JERSEY 08075
Area Code (609) 461-1239

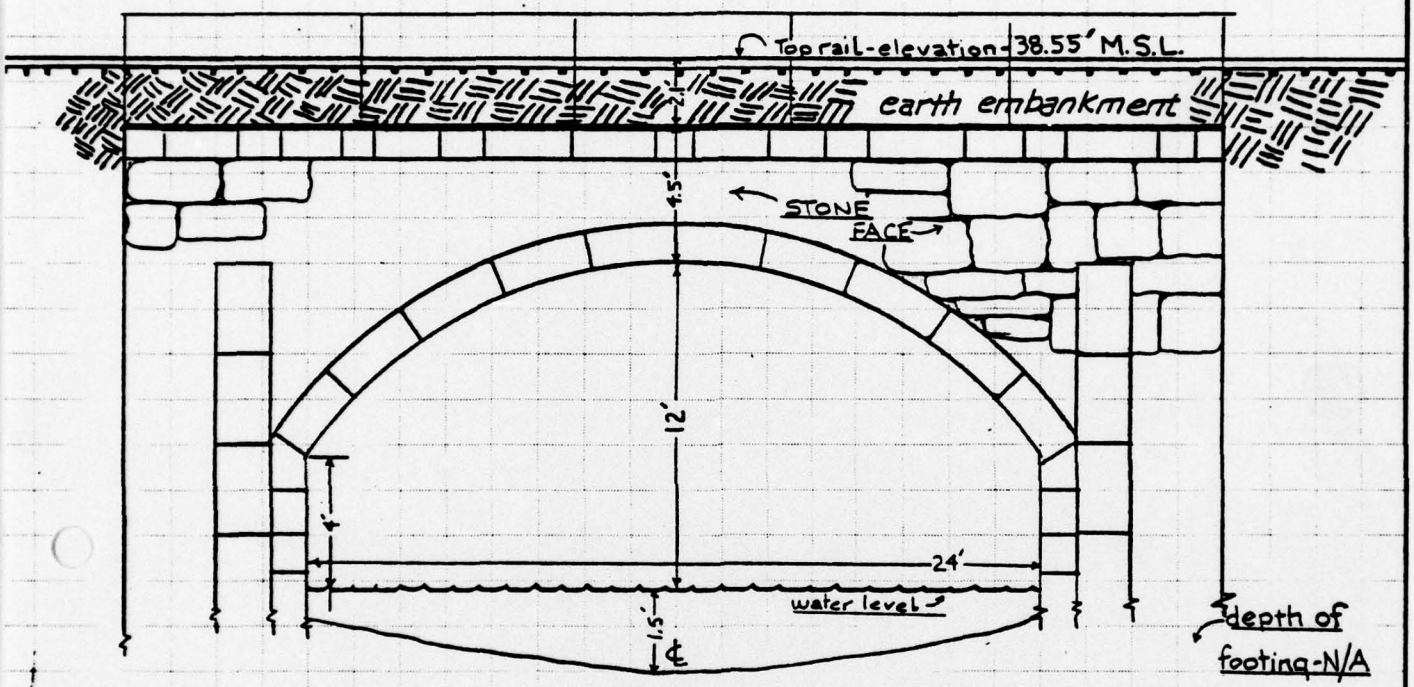
JOB 2089 · Wyoming Lake

SHEET NO. 7 OF

CALCULATED BY jhw DATE 2/19/79

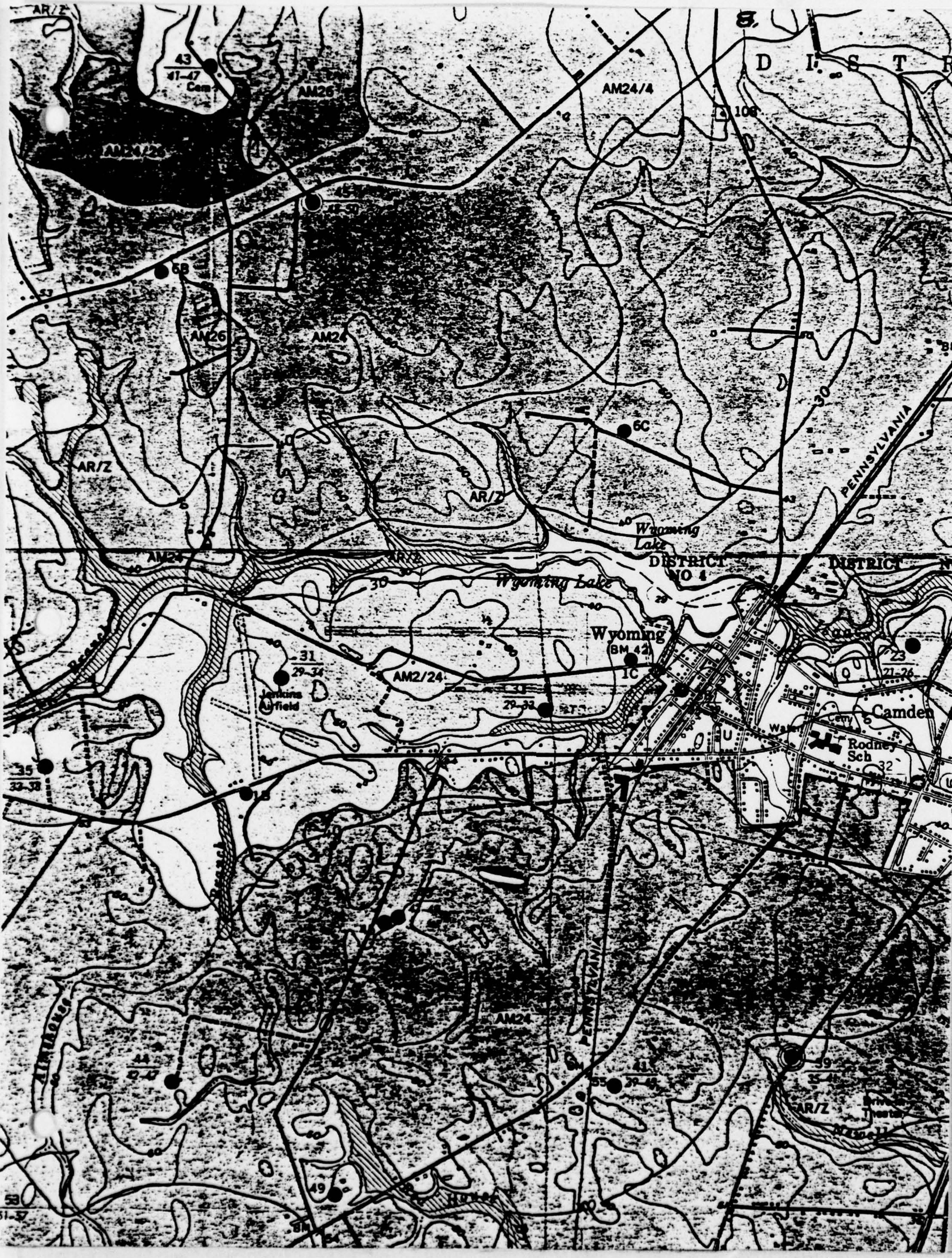
CHECKED BY DATE

SCALE



RAILROAD EMBANKMENT CULVERT

SCALE 1" = 60'


AR/Z
43
41–47
AM26
AM24/26
AM24/4
108
D I S T R
45
6B
AM26
AM24
6C
30
PENNSYLVANIA
AR/Z
Wyoming Lake
DISTRICT NO 4
DISTRICT
AM24
AR/Z
Wyoming Lake
31
29–34
Jenkins Airfield
AM2/24
Wyoming
(BM 42)
1C
33
29–33
23
21–26
Camden
Rodney Sch
32
35
33–38
AM24
44
41–47
41
39–43
39
35–43
AR/Z
49
58
51–57

According to our phone conversation with Mr. Robert R. Jordan, State Geologist with the Delaware Geological Surveys, the geology of the Wyoming area has not been mapped for publication as of this writing. However, we have included a partial map taken from Hydrologic Investigation Atlas HA-141 by Davis, Boggess and Coskey, 1965. The following information was derived:

The dam is located in an area mapped as an "urban area altered by man". The soil from which the embankment was constructed, based on our visual inspection, would be classified as AM-2 and AM2/2A. The soil characteristics are a non to slightly plastic, medium to fine sand. Historical geologists indicate the soil was derived from al fluvial deposit of the Pleistocene age.

Appendix A

Check List
Visual Inspection
Phase 1

Name Dam Wyoming Lake **County** Kent **State** Delaware **Coordinators** Krishna A.Patel
Division Eng.
Del.Dept. of
Natural Resources
& Environmental
Control

Date(s) Inspection 12-15-78
2-4-79 **Weather** Partly Sunny
Sunny **Temperature** 60°
35°

Pool Elevation at Time of Inspection 29 **M.S.L.** **Tailwater at Time of Inspection** 0.5 ~~M.S.L.~~
Above Bottom of Culvert

Inspection Personnel:

Daniel W. Jacobs, P.E.
I. Wayne Lippincott, P.E., P.P.
Patrick Kennedy, P.E.
James Willits

I. Wayne Lippincott, P.E., P.P. **Recorder**

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATION:
SEE PAGE ON LEAKAGE	N/A	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	N/A	
WATER PASSAGES	N/A	
FOUNDATION	N/A	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	N/A	
STRUCTURAL CRACKING	N/A	
VERTICAL AND HORIZONTAL ALIGNMENT	N/A	
MONOLITH JOINTS	N/A	
CONSTRUCTION JOINTS	N/A	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	The roadway embankment (dam) leading from Rt. 195 to the Mill structure is constructed of native material with an asphalt top. No cracking or subsidence was noted along the roadway.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	Sheet piling at the (north) most downstream wingwall has broken at anchorage. Probably inadequately tied back during reconstruction.	Monitor deflection of piling & compare to photograph attached.
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Sloughing and erosion were noted on both the up and down stream embankments. Erosion has been checked by placing rubble and/or broken asphalt on channel slope downstream.	Filling of gullies required on reservoir side.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	No noticible movement of embankment vertically or horizontally, except at sheet pile wall.	
RIPRAP FAILURES	N/A	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	No visible signs of leakage or distress at juncture of embankment with abutment wingwalls. Apparently downstream wingwalls (upper level) had begun to rotate due to loss of stabilizing fill. Has since been rectified.	Sheet piling and concrete slope protection added for stabilization.
ANY NOTICEABLE SEEPAGE	Seepage through embankment negligible.	
STAFF GAGE AND RECORDER	None at site.	
DRAINS	None observed.	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Tilted wall in diversion channel to Mill Raceway.	
INTAKE STRUCTURE	Raceway at Mill Dam with bar trashrack intake controlled by 3 underflow gates.	Trashrack is obstructed. Cleaning is required.
OUTLET STRUCTURE		
OUTLET CHANNEL	Not Applicable.	
EMERGENCY GATE	None	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	N/A	
APPROACH CHANNEL	N/A	
DISCHARGE CHANNEL	N/A	
BRIDGE AND PIERS	N/A	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	Mill Road Bridge culvert contains four lift gates or stoplogs each set at a different elevation. One lift gate is totally inoperable due to nailing of wood panel.	Gates in bad condition and requires outside lift assistance such as towtruck to pull gates.
APPROACH CHANNEL	No approach channel exists, except at diversion to Mill Raceway.	
DISCHARGE CHANNEL	Consists of double barrel concrete box culvert which discharges thru extended stepped mitered walls into the channel. Concrete apron spans between walls. Flared wings prevent embankment from sloughing into main channel.	Downstream wingwalls and slope protection restored.
BRIDGE AND PIERS	See above - box culvert is also referred to as Mill Road Bridge.	
GATES AND OPERATION EQUIPMENT	2'3" x 8' gates in extremely poor state of repair. No lifting mechanism available at dam spillway.	Gates must be repaired and made operable.

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None	
OBSERVATION WELLS	None	
WEIRS	None	
PIEZOMETERS	None	
OTHER	None	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Reservoir slopes upstream are quite low and heavily vegetated. All slopes inspected appear to be 4:1 or flatter. 5 or 6 willow trees were noted on the upstream side of the embankment.	
SEDIMENTATION	Sedimentation not particularly noticible.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Downstream main channel meanders slightly but converges with discharge channel from Mill Race at the 3 corrugated metal pipe arches @ Highway Bridge. Channel clear with vegetated flat slope on south and vegetated gentle slope on north.	
SLOPES	Slopes as noted above are heavily vegetated downstream. Near culvert north slope is approximately 3:1 and has been stabilized with broken asphalt.	
APPROXIMATE NO. OF HOMES AND POPULATION	One home exists on downstream side embankment. One motor home noted between highway bridge and railroad bridge on north side.	Mrs. Brown, leasee of home showed us photographs of resulting erosion of downstream embankment when dam was overtopped. We requested negatives but none were available.

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Not Available. Field survey made to define conditions at dam.
REGIONAL VICINITY MAP	Available.
CONSTRUCTION HISTORY	No available history of dam or appurtenant structures.
TYPICAL SECTIONS OF DAM	None available.
HYDROLOGIC/HYDRAULIC DATA	None available except downstream highway bridge designed for 50 year storm, 1974.
OUTLETS - PLAN	None available.
- DETAILS **- CONSTRAINTS** **- DISCHARGE RATINGS**	Plans and ratings developed at time of field survey.
RAINFALL/RESERVOIR RECORDS	None available.

ITEM	REMARKS
DESIGN REPORTS	None available.
GEOLOGY REPORTS	None available; State geologic mapping not performed in this area.
DESIGN COMPUTATIONS	Not available.
HYDROLOGY & HYDRAULICS	Not available.
DAM STABILITY	Not available.
SEEPAGE STUDIES	Not available
MATERIALS INVESTIGATIONS	None available.
BORING RECORDS	None available.
LABORATORY	None available.
FIELD	None available.
POST-CONSTRUCTION SURVEYS OF DAM	None available other than as-is survey done by Thomas Tyler Moore Associates in 1978.
BORROW SOURCES	Unknown

ITEM	REMARKS
SPILLWAY PLAN	Not available.
SECTIONS	Not available.
DETAILS	Not available.
OPERATING EQUIPMENT PLANS & DETAILS	Not available.

ITEM	REMARKS
MONITORING SYSTEMS	None observed.
MODIFICATIONS	Modification to downstream (Mill Road Culvert) wingwall for improvement of stability.
HIGH POOL RECORDS	Not available.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Not available.
PRIOR ACCIDENTS OR FAILURE OF DAM	None recorded.
DESCRIPTION	Not available.
REPORTS	Not available.
MAINTENANCE OPERATION RECORDS	None available.

Appendix B

PHOTOGRAPHIC INDEX

Photo 1 - Closeup view from upstream of Wyoming Lake Road Dam. Note: Damaged concrete beam, shortened lifting stem (center) and stoplogs out of guide paths (left side).

Photo 2 - View of upstream inlet area to Mill Road Dam structure. Note: Damaged/broken-off pilings that were apparently in use as the trash rack system.

Photo 3 - View of upstream inlet south side wingwall & damaged inlet gate out of guides. Note: Trees growing on embankment side and general spalling of concrete.

Photo 4 - Downstream view of Mill Road Dam outlet area Note: Concrete apron between wingwalls, metal sheet piling and broken bituminous material on earth embankment slope.

Photo 5 - Closeup view of south side downstream wingwall Mill Road Dam to show cracked condition that could indicate possible sheet piling tie back failure.

Photo 6 - View of Mill Race inlet area showing appurtenant building over top of inlet area. Note spalling of concrete support posts.

Photo 7 - Closeup view of Mill Race inlet showing condition of trash rack and stoplogged lift gates. Note: condition of wooden guides, lifting stems.

Photo 8 - Downstream view of Mill Race outlet. Note: Blocked sluice on left (north) side and mortared stone construction of building.

Photo 9 - Closeup of downstream Mill Race outlet structure. Note: Center wall pier shows no sign of deterioration on outside - deterioration is existing under the Mill; however, it could not be photographed due to lighting conditions.

Photo 10 - View of embankment crest, road and residential home (occupied by two people) located on the west side of the embankment crest. Note: Elevation of house first floor (rear porch elevation).

Photo 11 - View of widened embankment over Mill Race and of the Mill buildings.

Photo 12 - View of downstream Mill Race channel and peninsula separating the Mill Race downstream channel from the Mill Road downstream channel.

Photo 13 - View of the Mill Road Dam downstream channel, and partial view of the Rt. 195 roadway bridge culverts.

Photo 14 - View of the eroded upstream western Lake shore between the Mill Race Dam and the Mill Road Dam. Note: The surface erosion and broken stone and bituminous material.

Photo 15 - View of the downstream Mill Road Dam Channel. Note: The eroded condition and the partially corrective measures.

Photo 16 - View of the Rt. 195 culverts (partial) showing two of the three inlets under Rt. 195. Shot taken from the downstream Mill Race Channel.

Photo 17 - Upstream of The Pennsylvania R.R. arched stoned culvert. View of the channel and culvert taken from a location between the Rt. 195 culverts and the railroad.

Photo 18 - View from the center of the Mill Road showing the relative elevations of the Rt. 195 bridge and the Pennsylvania railroad line. Note that the railroad is at a considerably higher elevation than Rt. 195.

NOTE: All photographs were taken on February 4, 1979.

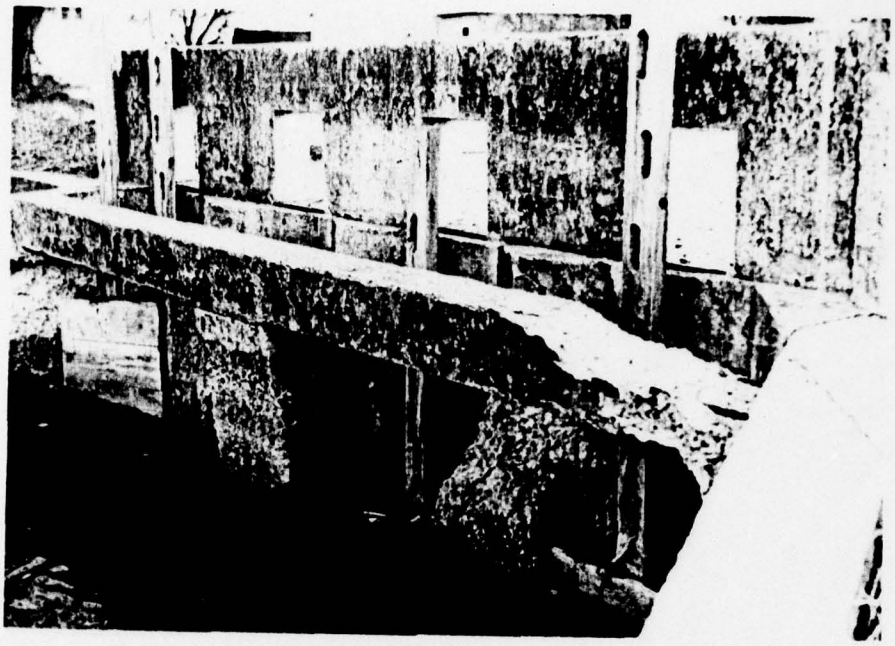


PHOTO 1
Mill Road Dam

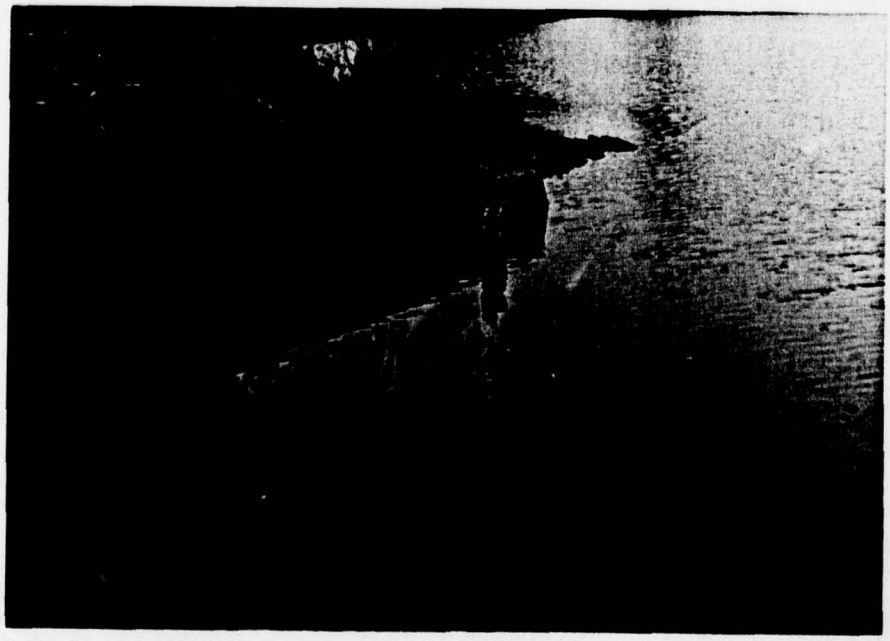


PHOTO 2
Mill Road Dam

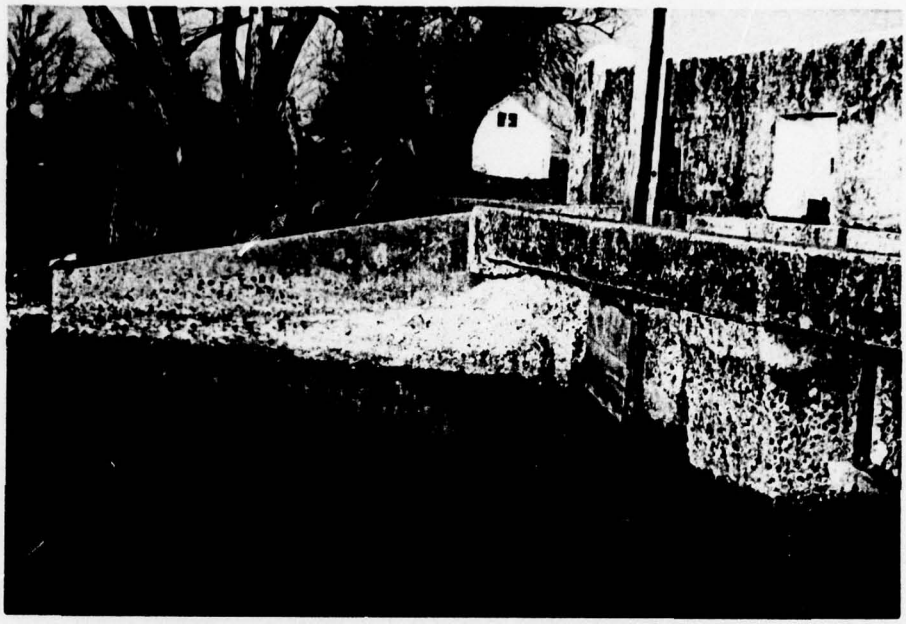


PHOTO 3

Mill Road Dam

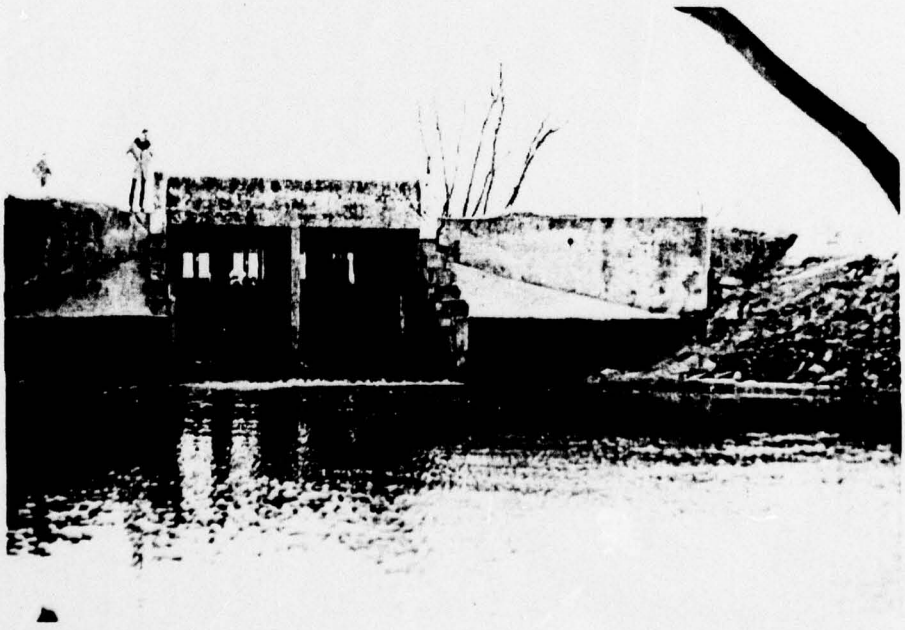


PHOTO 4

Mill Road Dam Outfall-Downstream

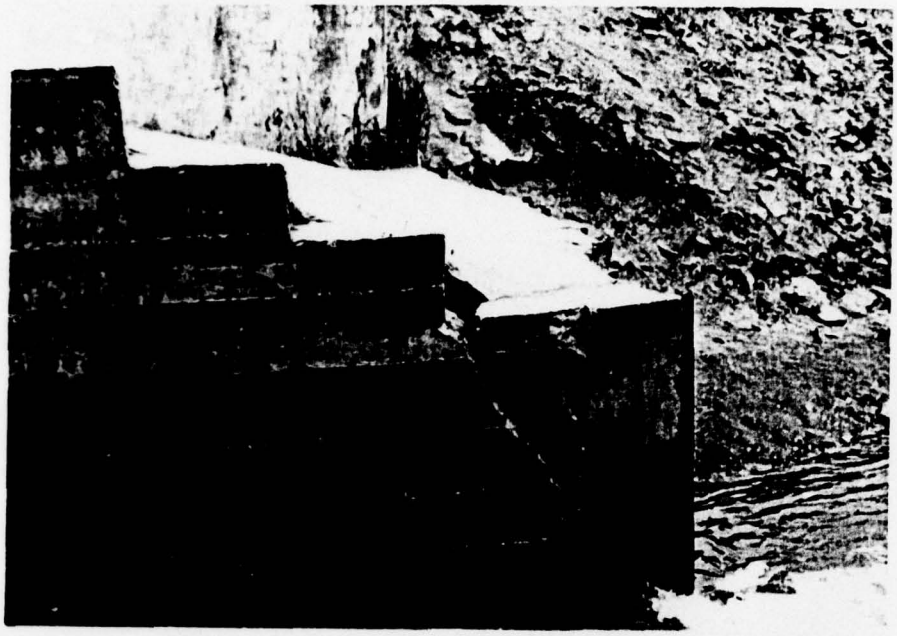


PHOTO 5

Mill Road Dam - Downstream

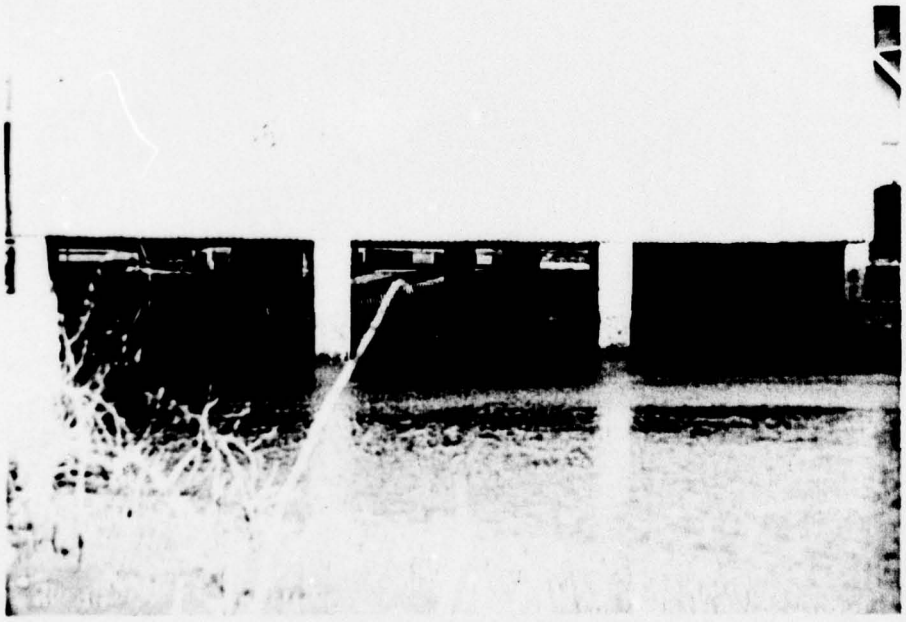


PHOTO 6

Mill Race Dam-Appurtenant Bldg.

PHOTO 7

Mill Race-Lift Stems & Trash Rack

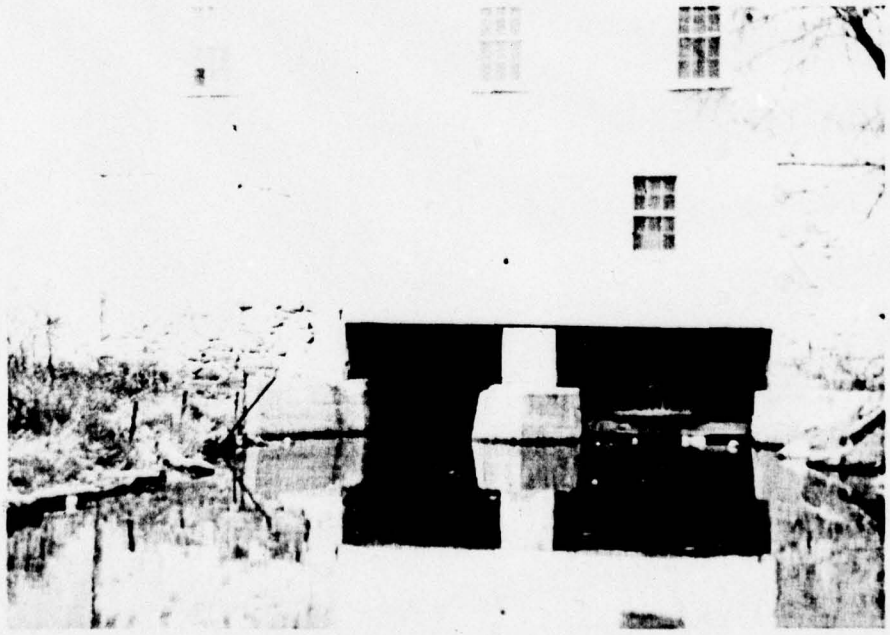


PHOTO 8

Downstream-Mill Race Outlet

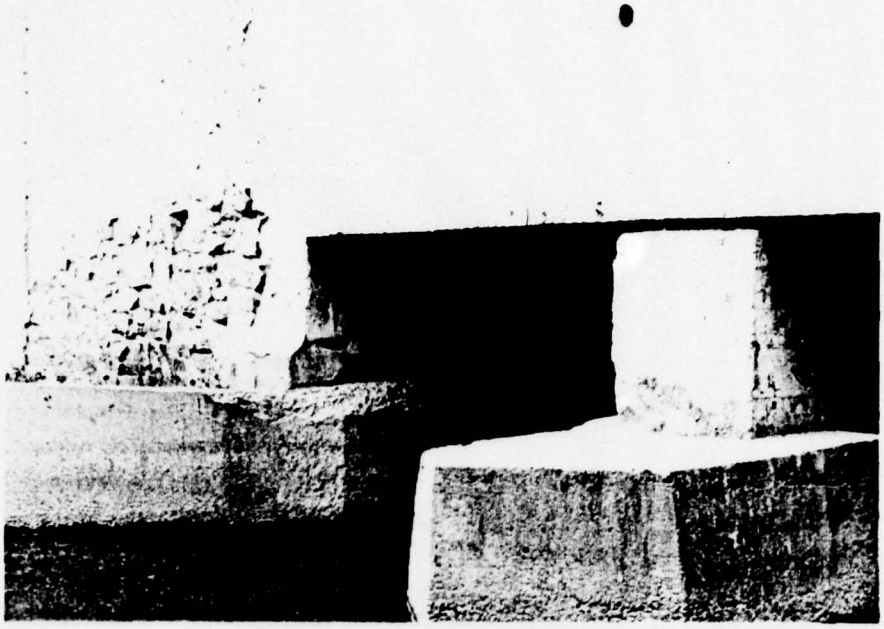


PHOTO 9
Downstream Outlet of Mill Race

PHOTO 10
Dwelling on Embankment South of
Mill Road Dam

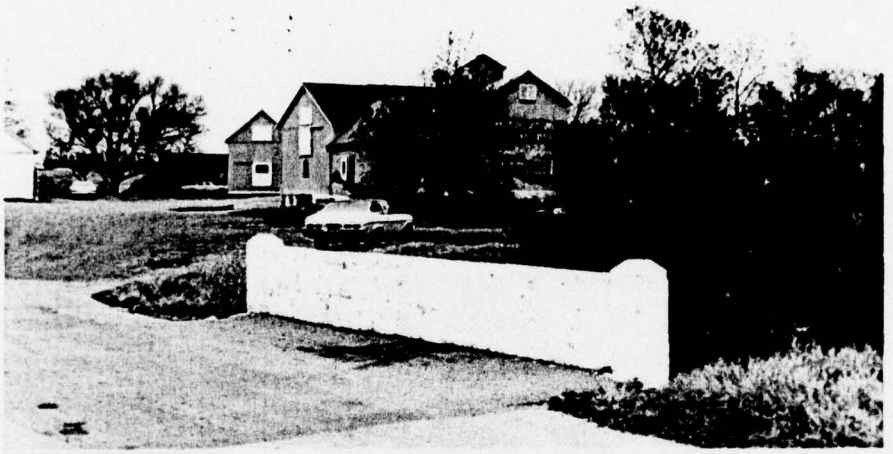


PHOTO 11

Mill Buildings

PHOTO 12

Mill Race-Downstream Channel

PHOTO 13

Mill Road Dam–Downstream Channel

PHOTO 14

Eroded Upstream Side Embankment

PHOTO 15

Downstream View of Eroded South-
Side - Mill Road Dam Channel

PHOTO 16
View of Route 195 Culverts From
Mill Race Channel

PHOTO 17
Pennsylvania Railroad Arch
Culvert

PHOTO 18
Overtop View-Route 195 and Penn.
Railroad From Mill Road

Appendix C

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 11.08 S.M.

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 165 A.F. @ El. 29

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): N/A

ELEVATION MAXIMUM DESIGN POOL: 34.05

ELEVATION TOP DAM: 32.5

CREST: Lift gates (stoplogs) at Bridge and at Mill

a. Elevation 29.0
b. Type Wood
c. Width N/A
d. Length 9.2 + 7.5 = 17
e. Location Spillover None
f. Number and Type of Gates 4 + 3 lift gates

OUTLET WORKS: Raceway At Mill

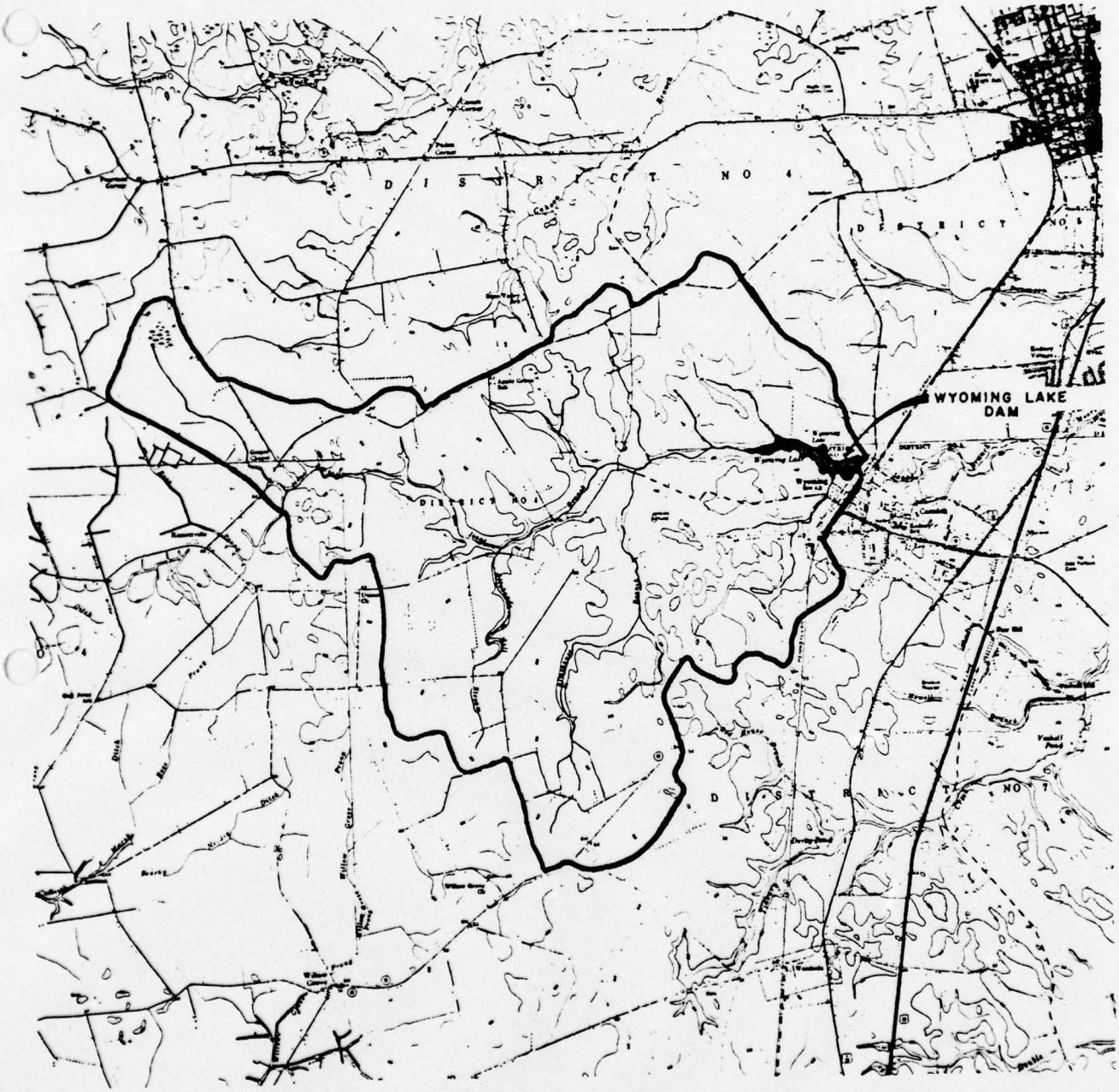
a. Type Channel to 3 Control Gates
b. Location At Mill Diversion
c. Entrance inverts N/A
d. Exit inverts N/A
e. Emergency draindown facilities None

HYDROMETEOROLOGICAL GAGES: None

a. Type
b. Location
c. Records

MAXIMUM NON-DAMAGING DISCHARGE: Not Applicable

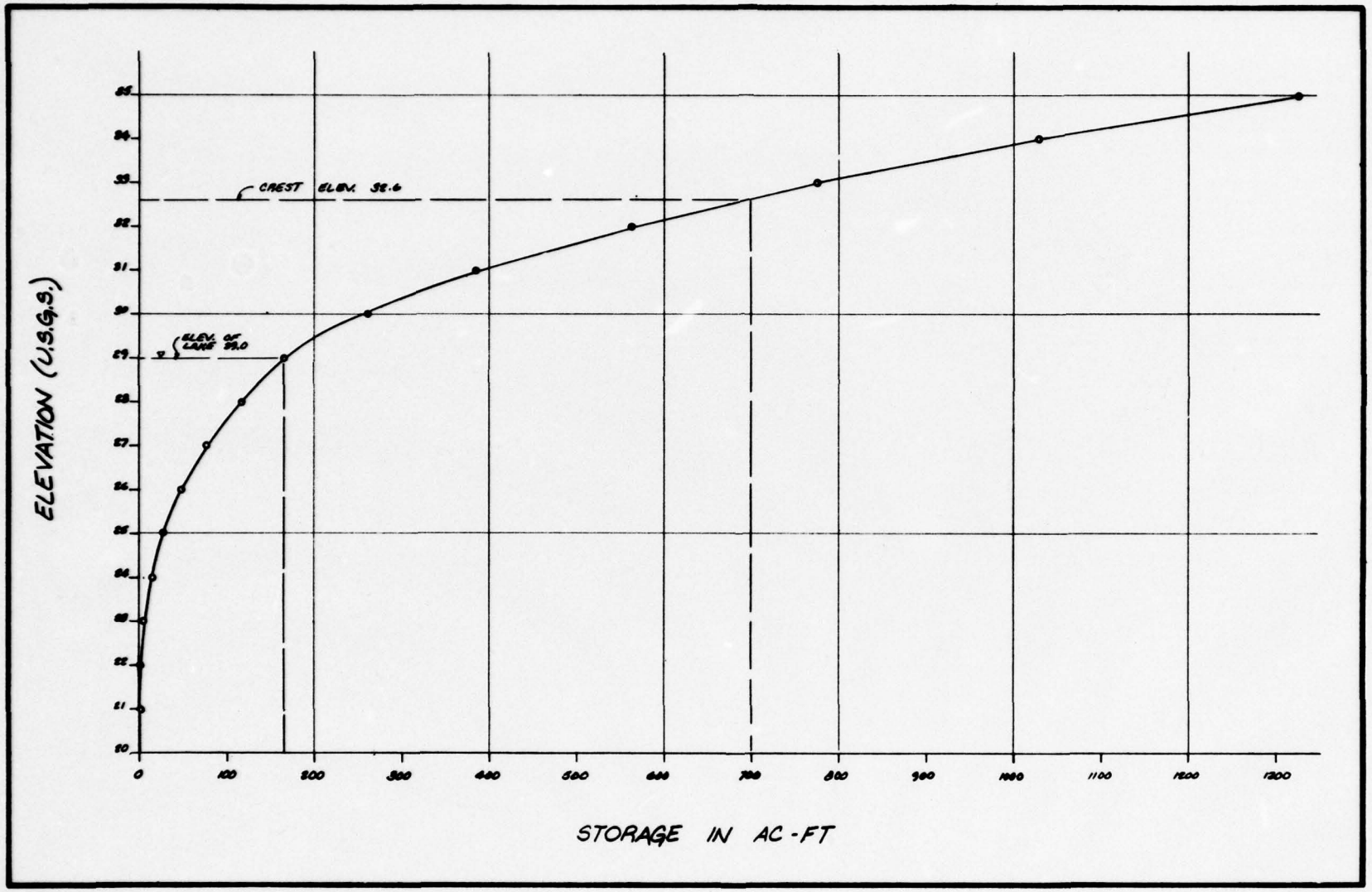
Appendix D



CONTOUR INTERVAL 10 FEET

WATERSHED MAP

WYOMING LAKE DAM


CREST ELEV. 32.6
ELEV. OF LAND 29.0
ELEVATION (U.S.G.S.)
STORAGE IN AC-FT
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300

Lippincott Engineering Associates
501 Burlington Avenue
DELANCO, NEW JERSEY 08075
Area Code (609) 461-1239

JOB 7089 WYOMING LAKE DAM
SHEET NO. 17 OF
CALCULATED BY DATE
CHECKED BY DATE
SCALE

ASSUMETIONS

1) COMPUTATIONS FOR DISCHARGE AT BATTERBOARDS BASED ON BUREAU OF PUBLIC ROADS CHART NO. 1.

2) COMPUTATIONS FOR FLOW CRESTING ROAD BASED UPON $Q = C L H^{1.5}$ WHERE $C = 2.65$, AVERAGE ROAD ELEVATION = 32.6

3) COMPUTATIONS FOR t_p & t_c BASED UPON SNYDER

$t_p = C_t (L \times L_{CA})^{.3}$ $\qquad t_c = \left(\frac{11.9 L^3}{H}\right)^{0.385}$

$C_t = 3.0$ (AS PER CORPS OF ENGINEERS)

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Area Code (609) 461-1239

JOB 2089 WYOMING LAKE DAM
SHEET NO. 2 OF
CALCULATED BY DATE 2/79
CHECKED BY DATE
SCALE

I) A_d = DRAINAGE AREA = 11.08 SQUARE MILES

L = LENGTH OF LONGEST WATER COURSE = 6.49 MILES

L_{CA} = LENGTH FROM DAM ALONG WATER COURSE TO PERPENDICULAR INTERSECTING CENTROID OF AREA = 2.46 MILES

C_p = 0.5 (AS PER CORPS OF ENGINEERS)

C_t = 3.0 (AS PER CORPS OF ENGINEERS)

II) t_p = TIME TO PEAK = $C_t(L \times L_{CA})^{.3} = 3.0(6.49 \times 2.46)^{.3}$ = 6.89 HRS.

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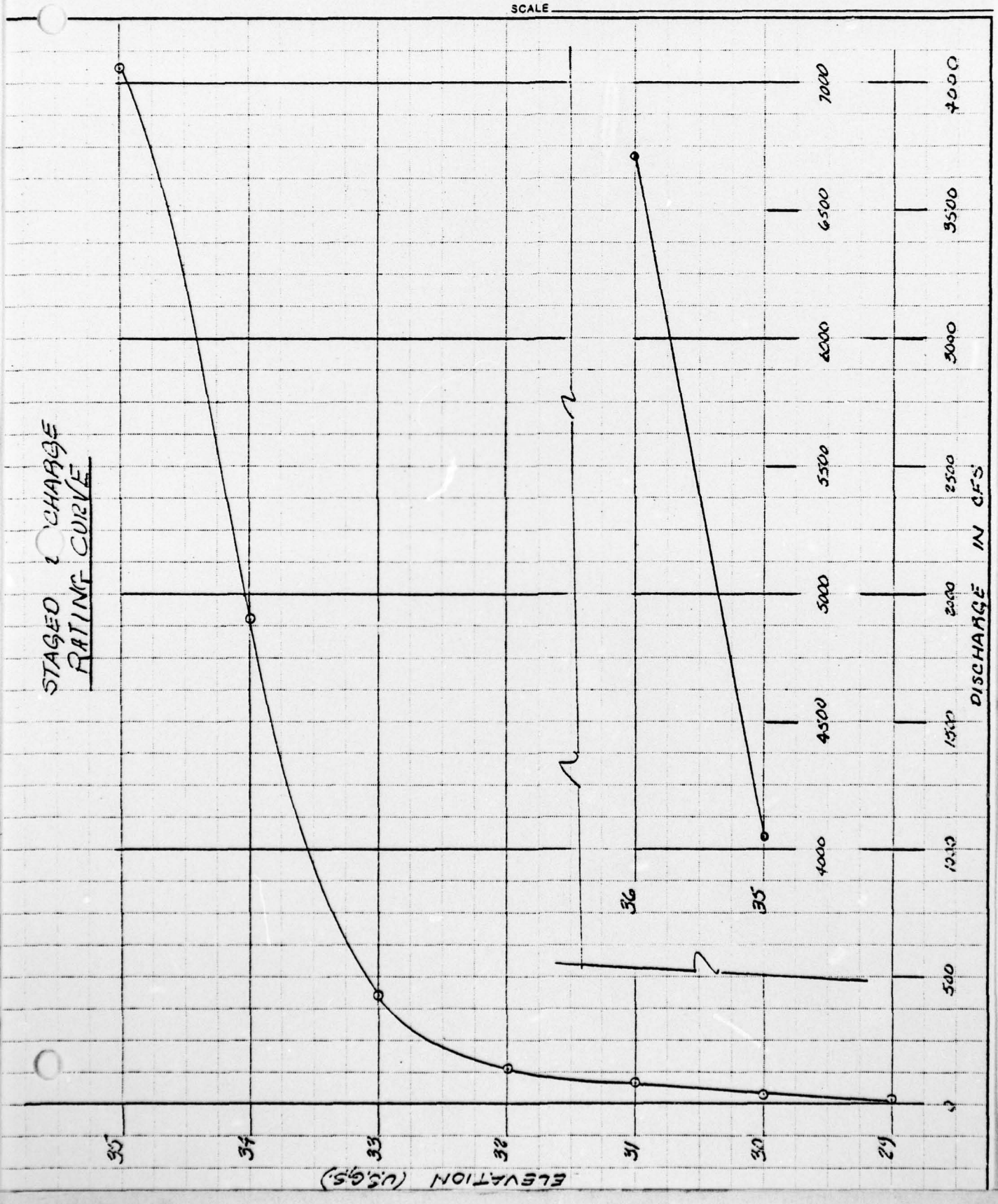
SHEET NO. 3 OF

CALCULATED BY [illegible] DATE 1/79

CHECKED BY DATE

SCALE



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DELANCO, NEW JERSEY 08075
Area Code (609) 461-1239

JOB 2057 WYOMING LAKE DAM
SHEET NO. 4 OF
CALCULATED BY JWW DATE
CHECKED BY DATE
SCALE

ELEV.	C_6	L_6	H_6	Q_6	Q_1	Q_2	Q_3	Q_4	Q_5	Q TOTAL
29					3.1	0.9	—	—	—	4.0
30					13.6	9.7	6.9	5.0	—	35.2
31					25.3	20.5	16.6	13.6	1.8	77.8
32					36.6	31.1	26.2	22.3	7.2	123.4 163.0
33	2.65	390	0.4	261.5	46.6	39.3	33.8	28.3	12.0	421.5
34			1.4	1712.0	52.9	46.0	39.1	33.7	14.8	1898.5
35			2.4	3842.6	58.7	50.6	43.9	37.5	17.0	4050.3
36			3.4	6479.3	64.4	55.2	48.3	41.4	18.9	6707.5

NOTES:

1. Q_1 TO Q_4 REFER TO FLOW THROUGH GATES AT MILL RD. BRIDGE, Q_5 REFERS TO GATE #5 AT MILL. Q_6 REFERS TO FLOW OVER CREST OF MILL RD. (SEE FOLLOWING PAGE)

2. REFER TO H.E.C. - 3 PUBLICATION U.S.D.O.T.

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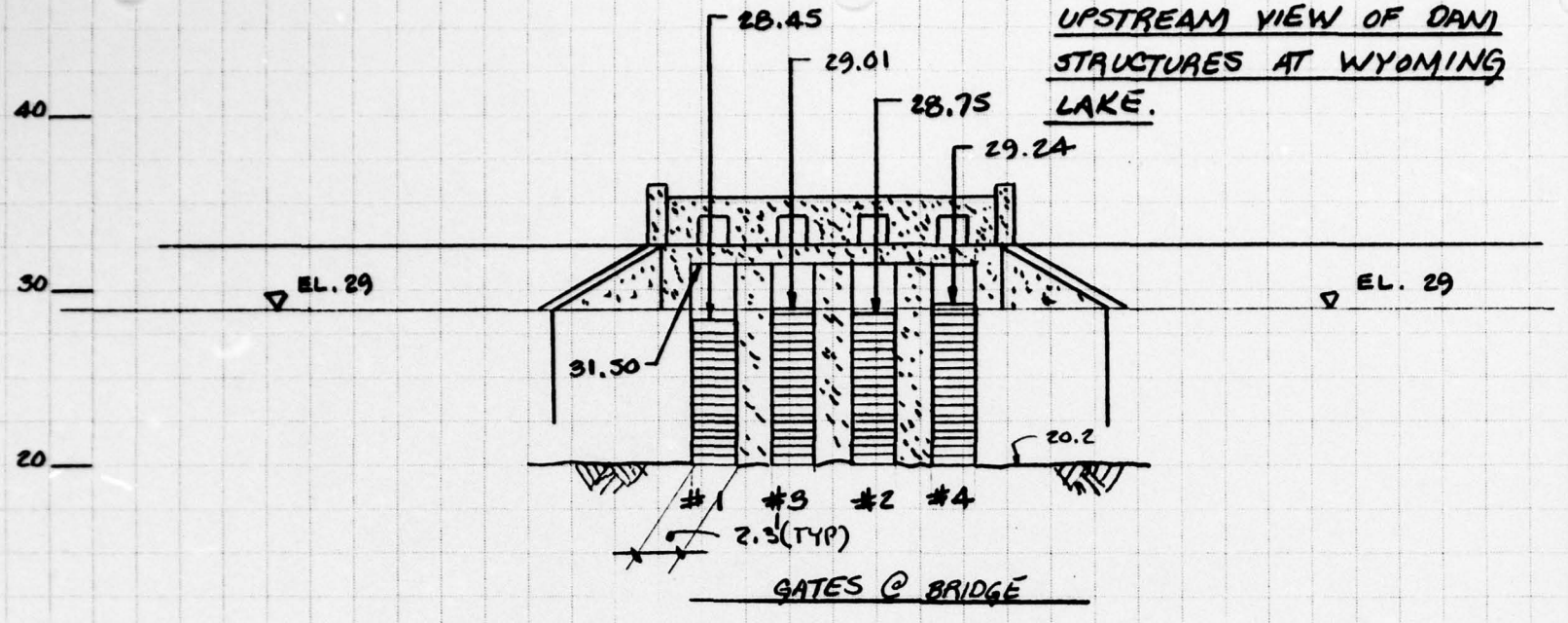
Area Code (609) 461-1239

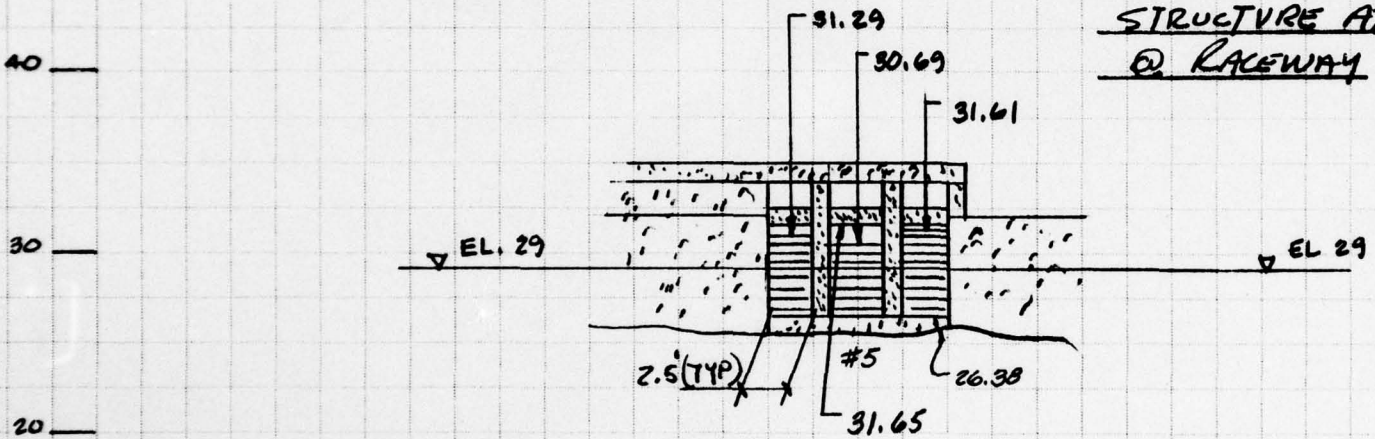
SHEET NO. 5 OF
CALCULATED BY DATE
CHECKED BY DATE
SCALE 1" = 10'

UPSTREAM VIEW OF DAM STRUCTURES AT WYOMING LAKE.



GATES @ BRIDGE

UPSTREAM VIEW OF STRUCTURE AT DIVERSION @ RACEWAY



GATES @ MILL

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501 Burlington Avenue
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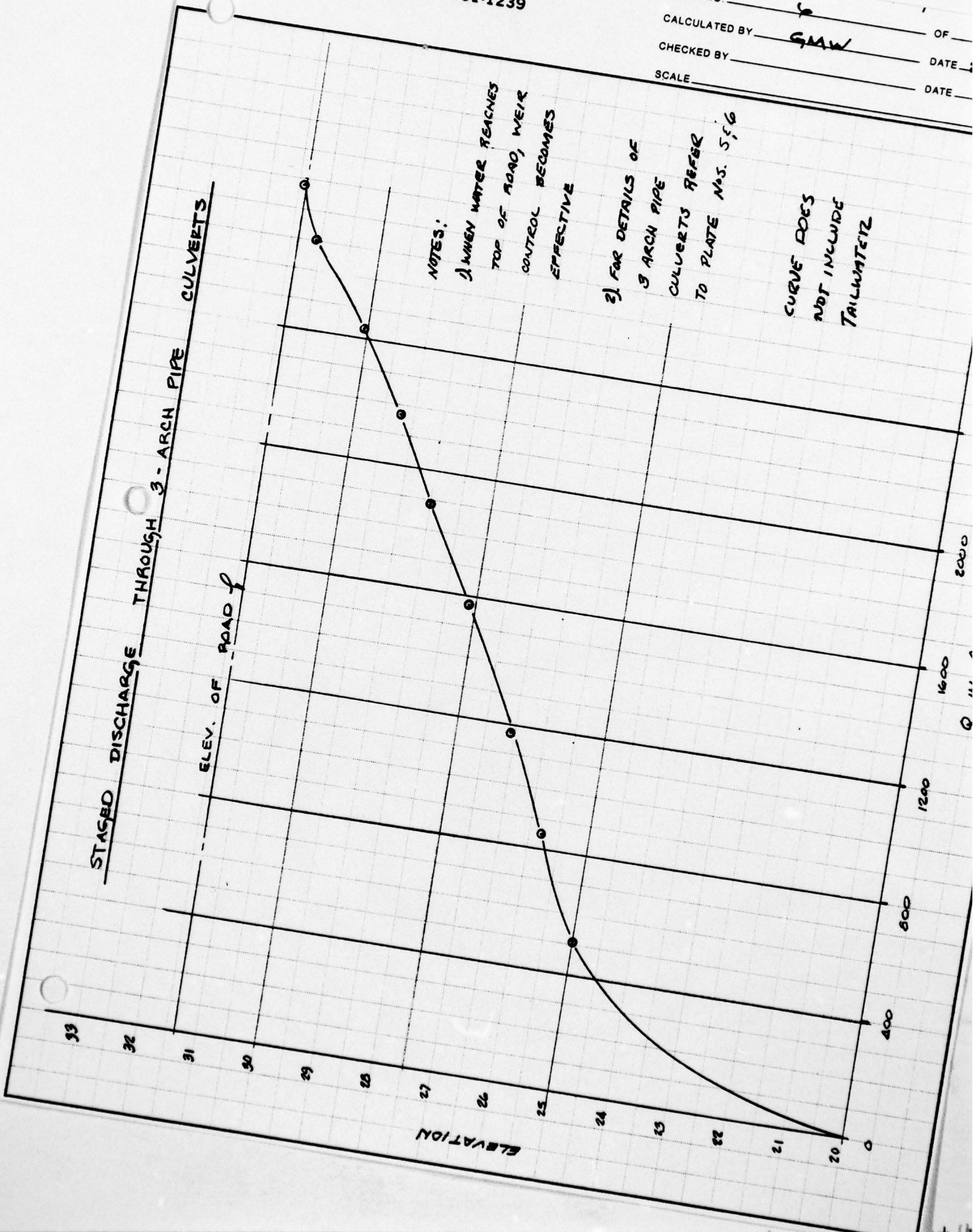
Area Code (609) 461-1239

SHEET NO. 6
CALCULATED BY GMW OF
CHECKED BY DATE
SCALE DATE



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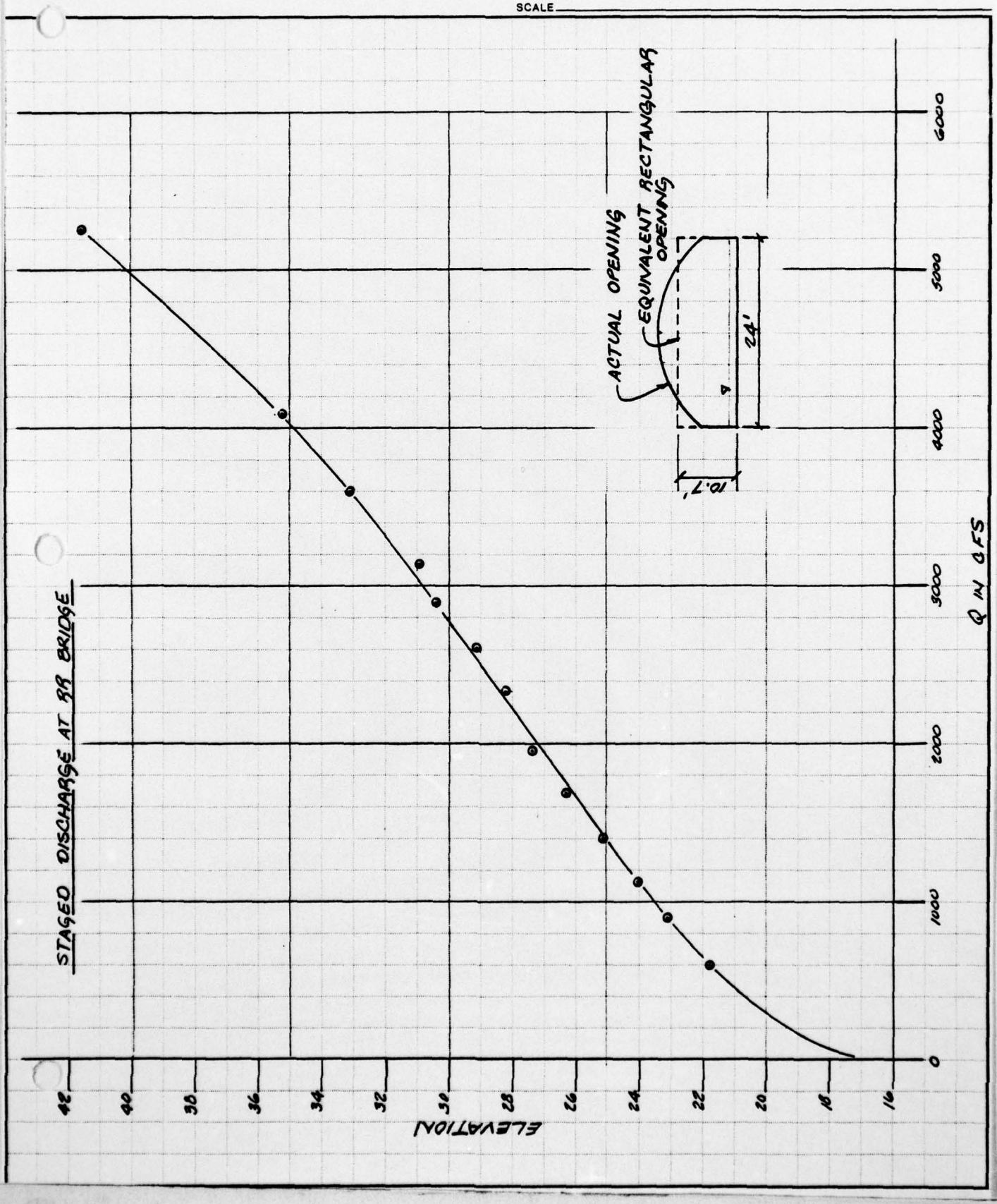
SHEET NO. 7 OF
CALCULATED BY GMM DATE 2/79
CHECKED BY DATE
SCALE



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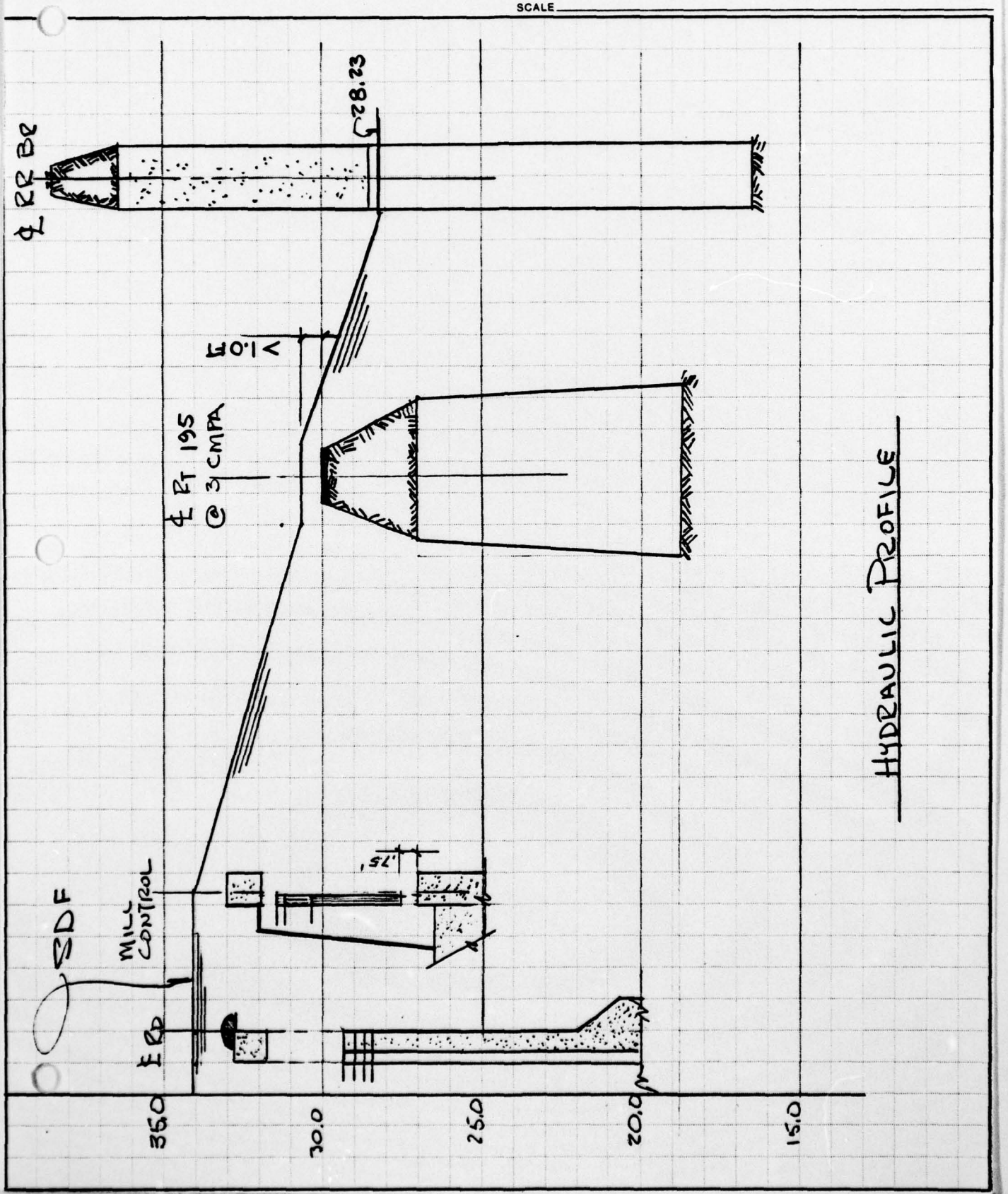
DELANCO, NEW JERSEY 08075
Area Code (609) 461-1239

SHEET NO. 8 OF
CALCULATED BY WJ DATE 2-79
CHECKED BY DATE
SCALE



HYDRAULIC PROFILE

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
 LAST MODIFICATION  21 AUG 78
**********
    1          A1       WYOMING LAKE DAM
    2          A2       PHASE I DAM INSPECTION -- STATE OF DELAWARE
    3          A3       PATRICK A. KENNEDY, THOMAS TYLER MOORE ASSOCIATES
    4          B   120        0       30        0        0        0        0        0        0        0
    5          B1    5
    6          J     1        1        1
    7          J1  1.0
    8          K     0        1                          0        0        1        0
    9          K1       INFLOW HYDROGRAPH TO WYOMING LAKE
   10          M     0        1    11.08                 0        0                          1
   11          O    48      7.6
   12          O1 .0055    .0055    .0055    .0055    .0065    .0065    .0065    .0065    .008     .008
   13          O1  .008     .008      .01      .01      .01      .01    .0135    .0135    .016     .018
   14          O1  .023     .031     .048      .38     .072     .037     .027     .021    .015     .015
   15          O1  .015     .015     .009     .009     .009     .009     .009     .009    .009     .009
   16          O1  .006     .006     .006     .006     .006     .006     .006     .006
   17          T                                                       1.0      .05
   18          W   6.9      .50
   19          X   0.0      0.0      1.0
   20          K     1        2                          0        0        1        0
   21          K1       ROUTE HYDROGRAPH THROUGH WYOMING LAKE DAM
   22          Y                                       1        1
   23          Y1    1                                                 165       -1
   24          Y4   29       30       31       32       33       34       35
   25          Y5    4       35       78      123      421     1898     4050
   26          $S    0      165      261      386      562      776     1027     1325
   27          $E   20       29       30       31       32       33       34       35
   28          $$ 29.0
   29          $J 32.5
   30          K    99
```

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT 1
ROUTE HYDROGRAPH TO 2
END OF NETWORK

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  21 AUG 78
**********

RUN  DATE* 79/02/21.
     TIME* 14.11.24.
```

WYOMING LAKE DAM
PHASE I DAM INSPECTION -- STATE OF DELAWARE
PATRICK A. KENNEDY, THOMAS TYLER MOORE ASSOCIATES

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
120	0	30	0	0	0	0	0	0	0
			JOPER	NWT	LROPT	TRACE			
			5	0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 1 LRTIO= 1

RTIOS= 1.00

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH TO WYOMING LAKE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
0	1	11.08	0.00	11.08	0.00	0.000	0	1	0

PRECIP DATA

NP	STORM	DAJ	DAK
48	7.60	0.00	0.00

PRECIP PATTERN

.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.02	.02
.02	.03	.05	.38	.07	.04	.03	.02	.02	.02
.02	.02	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01		

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA
TP= 6.90 CP= .50 NTA= 0

RECESSION DATA
STRTQ= 0.00 QRCSN= 0.00 RTIOR= 1.00
APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC=14.52 AND R=18.89 INTERVALS

UNIT HYDROGRAPH 100 END-OF-PERIOD ORDINATES, LAG= 6.87 HOURS, CP= .50 VOL= .99

7.	36.	73.	115.	159.	223.	281.	339.	394.	440.
477.	505.	524.	531.	521.	498.	472.	448.	425.	403.
382.	362.	344.	326.	309.	293.	278.	264.	250.	237.
225.	213.	202.	192.	182.	173.	164.	155.	147.	140.
132.	126.	119.	113.	107.	102.	96.	91.	87.	82.
78.	74.	70.	67.	63.	60.	57.	54.	51.	48.
46.	44.	41.	39.	37.	35.	33.	32.	30.	29.
27.	25.	24.	23.	22.	21.	20.	19.	18.	17.
16.	15.	14.	14.	13.	12.	12.	11.	10.	10.
9.	9.	8.	8.	8.	7.	7.	6.	6.	6.

0 END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.30	1	.04	0.00	.04	0.	1.02	6.30	61	0.00	0.00	0.00	1027.
1.01	1.00	2	.04	0.00	.04	0.	1.02	7.00	62	0.00	0.00	0.00	974.
1.01	1.30	3	.04	0.00	.04	0.	1.02	7.30	63	0.00	0.00	0.00	924.
1.01	2.00	4	.04	0.00	.04	0.	1.02	8.00	64	0.00	0.00	0.00	877.
1.01	2.30	5	.05	0.00	.05	0.	1.02	8.30	65	0.00	0.00	0.00	831.
1.01	3.00	6	.05	0.00	.05	0.	1.02	9.00	66	0.00	0.00	0.00	788.
1.01	3.30	7	.05	0.00	.05	0.	1.02	9.30	67	0.00	0.00	0.00	748.
1.01	4.00	8	.05	0.00	.05	0.	1.02	10.00	68	0.00	0.00	0.00	709.
1.01	4.30	9	.05	0.00	.06	0.	1.02	10.30	69	0.00	0.00	0.00	673.
1.01	5.00	10	.06	0.00	.06	0.	1.02	11.00	70	0.00	0.00	0.00	638.
1.01	5.30	11	.06	0.00	.06	0.	1.02	11.30	71	0.00	0.00	0.00	605.
1.01	6.00	12	.06	0.00	.06	0.	1.02	12.00	72	0.00	0.00	0.00	574.
1.01	6.30	13	.08	0.00	.08	0.	1.02	12.30	73	0.00	0.00	0.00	544.
1.01	7.00	14	.08	0.00	.08	0.	1.02	13.00	74	0.00	0.00	0.00	516.
1.01	7.30	15	.08	0.00	.08	0.	1.02	13.30	75	0.00	0.00	0.00	490.
1.01	8.00	16	.08	0.00	.08	0.	1.02	14.00	76	0.00	0.00	0.00	464.
1.01	8.30	17	.10	.01	.09	0.	1.02	14.30	77	0.00	0.00	0.00	440.
1.01	9.00	18	.10	.08	.03	1.	1.02	15.00	78	0.00	0.00	0.00	418.
1.01	9.30	19	.12	.10	.03	4.	1.02	15.30	79	0.00	0.00	0.00	396.
1.01	10.00	20	.14	.11	.03	11.	1.02	16.00	80	0.00	0.00	0.00	376.
1.01	10.30	21	.17	.15	.03	24.	1.02	16.30	81	0.00	0.00	0.00	356.
1.01	11.00	22	.24	.21	.03	42.	1.02	17.00	82	0.00	0.00	0.00	338.
1.01	11.30	23	.35	.34	.03	72.	1.02	17.30	83	0.00	0.00	0.00	320.
1.01	12.00	24	2.89	2.86	.03	138.	1.02	18.00	84	0.00	0.00	0.00	304.
1.01	12.30	25	.55	.52	.02	265.	1.02	18.30	85	0.00	0.00	0.00	288.
1.01	13.00	26	.28	.26	.03	440.	1.02	19.00	86	0.00	0.00	0.00	273.
1.01	13.30	27	.21	.18	.03	649.	1.02	19.30	87	0.00	0.00	0.00	259.
1.01	14.00	28	.15	.13	.03	886.	1.02	20.00	88	0.00	0.00	0.00	246.
1.01	14.30	29	.11	.09	.03	1142.	1.02	20.30	89	0.00	0.00	0.00	233.
1.01	15.00	30	.11	.09	.03	1411.	1.02	21.00	90	0.00	0.00	0.00	221.
1.01	15.30	31	.11	.09	.03	1685.	1.02	21.30	91	0.00	0.00	0.00	210.
1.01	16.00	32	.11	.09	.03	1942.	1.02	22.00	92	0.00	0.00	0.00	199.
1.01	16.30	33	.07	.04	.03	2169.	1.02	22.30	93	0.00	0.00	0.00	189.
1.01	17.00	34	.07	.04	.03	2359.	1.02	23.00	94	0.00	0.00	0.00	179.
1.01	17.30	35	.07	.04	.03	2510.	1.02	23.30	95	0.00	0.00	0.00	170.
1.01	18.00	36	.07	.04	.03	2617.	1.03	0.00	96	0.00	0.00	0.00	161.
1.01	18.30	37	.07	.04	.03	2676.	1.03	.30	97	0.00	0.00	0.00	153.
1.01	19.00	38	.07	.04	.03	2672.	1.03	1.00	98	0.00	0.00	0.00	145.
1.01	19.30	39	.07	.04	.03	2615.	1.03	1.30	99	0.00	0.00	0.00	137.
1.01	20.00	40	.07	.04	.03	2537.	1.03	2.00	100	0.00	0.00	0.00	130.
1.01	20.30	41	.05	.02	.03	2455.	1.03	2.30	101	0.00	0.00	0.00	124.
1.01	21.00	42	.05	.02	.03	2370.	1.03	3.00	102	0.00	0.00	0.00	117.
1.01	21.30	43	.05	.02	.03	2285.	1.03	3.30	103	0.00	0.00	0.00	111.
1.01	22.00	44	.05	.02	.03	2201.	1.03	4.00	104	0.00	0.00	0.00	105.

1.01	22.30	45	.05	.02	.03	2114.	1.03	4.30	105	0.00	0.00	0.00	100.
1.01	23.00	46	.05	.02	.03	2036.	1.03	5.00	106	0.00	0.00	0.00	95.
1.01	23.30	47	.05	.02	.03	1956.	1.03	5.30	107	0.00	0.00	0.00	90.
1.02	0.00	48	.05	.02	.03	1878.	1.03	6.00	108	0.00	0.00	0.00	85.
1.02	.30	49	0.00	0.00	0.00	1803.	1.03	6.30	109	0.00	0.00	0.00	81.
1.02	1.00	50	0.00	0.00	0.00	1729.	1.03	7.00	110	0.00	0.00	0.00	77.
1.02	1.30	51	0.00	0.00	0.00	1657.	1.03	7.30	111	0.00	0.00	0.00	73.
1.02	2.00	52	0.00	0.00	0.00	1587.	1.03	8.00	112	0.00	0.00	0.00	69.
1.02	2.30	53	0.00	0.00	0.00	1517.	1.03	8.30	113	0.00	0.00	0.00	65.
1.02	3.00	54	0.00	0.00	0.00	1450.	1.03	9.00	114	0.00	0.00	0.00	62.
1.02	3.30	55	0.00	0.00	0.00	1384.	1.03	9.30	115	0.00	0.00	0.00	59.
1.02	4.00	56	0.00	0.00	0.00	1320.	1.03	10.00	116	0.00	0.00	0.00	56.
1.02	4.30	57	0.00	0.00	0.00	1257.	1.03	10.30	117	0.00	0.00	0.00	53.
1.02	5.00	58	0.00	0.00	0.00	1197.	1.03	11.00	118	0.00	0.00	0.00	50.
1.02	5.30	59	0.00	0.00	0.00	1138.	1.03	11.30	119	0.00	0.00	0.00	47.
1.02	6.00	60	0.00	0.00	0.00	1082.	1.03	12.00	120	0.00	0.00	0.00	44.
									SUM	7.60	5.82	1.78	82373.
										(193.)	(148.)	(45.)	(2332.54)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2676.	2453.	1514.	686.	82352.
CMS	76.	69.	43.	19.	2332.
INCHES		2.06	5.08	5.76	5.76
MM		52.32	129.16	146.34	146.34
AC-FT		1217.	3003.	3403.	3403.
THOUS CU M		1501.	3705.	4197.	4197.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 1

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	1.	4.	11.
24.	42.	72.	138.	265.	440.	649.	886.	1142.	1411.
1685.	1942.	2169.	2359.	2510.	2617.	2676.	2672.	2615.	2537.
2455.	2370.	2285.	2201.	2118.	2036.	1956.	1878.	1803.	1729.
1657.	1587.	1517.	1450.	1384.	1320.	1257.	1197.	1138.	1082.
1027.	974.	924.	877.	831.	788.	748.	709.	673.	638.
605.	574.	544.	516.	490.	464.	440.	418.	396.	376.
356.	338.	320.	304.	288.	273.	259.	246.	233.	221.
210.	199.	189.	179.	170.	161.	153.	145.	137.	130.
124.	117.	111.	105.	100.	95.	90.	85.	81.	77.
73.	69.	65.	62.	59.	56.	53.	50.	47.	44.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2676.	2453.	1514.	686.	82352.
CMS	76.	69.	43.	19.	2332.
INCHES		2.06	5.08	5.76	5.76
MM		52.32	129.16	146.34	146.34
AC-FT		1217.	3003.	3403.	3403.
THOUS CU M		1501.	3705.	4197.	4197.

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HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THROUGH WYOMING LAKE DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

CLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	165.	-1

STAGE	29.0	30.0	31.0	32.0	33.0	34.0	35.0	
FLOW	4.	35.	78.	123.	421.	1898.	4050.	
CAPACITY=	0.	100.	261.	386.	562.	776.	1027.	1325.
ELEVATION=	20.	29.	30.	31.	32.	33.	34.	35.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
29.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
32.5	0.0	0.0	0.

STATION 2, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

MO.DA	HR.MN	PERIOD	HOURS	INFLOW	OUTFLOW	STORAGE	STAGE
1.01	.30	1	.50	0.	4.	165.	29.0
1.01	1.00	2	1.00	0.	4.	165.	29.0
1.01	1.30	3	1.50	0.	4.	165.	29.0
1.01	2.00	4	2.00	0.	4.	165.	29.0
1.01	2.30	5	2.50	0.	4.	165.	29.0
1.01	3.00	6	3.00	0.	4.	165.	29.0
1.01	3.30	7	3.50	0.	4.	165.	29.0
1.01	4.00	8	4.00	0.	4.	165.	29.0
1.01	4.30	9	4.50	0.	4.	164.	29.0
1.01	5.00	10	5.00	0.	4.	164.	29.0
1.01	5.30	11	5.50	0.	4.	164.	29.0
1.01	6.00	12	6.00	0.	4.	164.	29.0
1.01	6.30	13	6.50	0.	4.	164.	29.0
1.01	7.00	14	7.00	0.	4.	164.	29.0
1.01	7.30	15	7.50	0.	4.	164.	29.0
1.01	8.00	16	8.00	0.	4.	164.	28.9
1.01	8.30	17	8.50	0.	4.	164.	28.9
1.01	9.00	18	9.00	1.	4.	164.	28.9
1.01	9.30	19	9.50	4.	4.	164.	28.9
1.01	10.00	20	10.00	11.	4.	164.	28.9
1.01	10.30	21	10.50	24.	4.	164.	29.0
1.01	11.00	22	11.00	42.	4.	165.	29.0
1.01	11.30	23	11.50	72.	5.	168.	29.0
1.01	12.00	24	12.00	136.	6.	172.	29.1
1.01	12.30	25	12.50	265.	9.	180.	29.2
1.01	13.00	26	13.00	440.	13.	194.	29.3
1.01	13.30	27	13.50	649.	20.	216.	29.5
1.01	14.00	28	14.00	886.	30.	246.	29.8
1.01	14.30	29	14.50	1142.	44.	287.	30.2
1.01	15.00	30	15.00	1411.	61.	337.	30.6

1.01	15.30	31	15.50	1685.	81.	398.	31.1
1.01	16.00	32	16.00	1942.	99.	469.	31.5
1.01	16.30	33	16.50	2169.	120.	550.	31.9
1.01	17.00	34	17.00	2359.	226.	636.	32.3
1.01	17.30	35	17.50	2510.	350.	725.	32.8
1.01	18.00	36	18.00	2617.	625.	811.	33.1
1.01	18.30	37	18.50	2676.	1063.	885.	33.4
1.01	19.00	38	19.00	2672.	1413.	944.	33.7
1.01	19.30	39	19.50	2615.	1679.	990.	33.9
1.01	20.00	40	20.00	2537.	1874.	1023.	34.0
1.01	20.30	41	20.50	2455.	2312.	1040.	34.0
1.01	21.00	42	21.00	2370.	2334.	1043.	34.1
1.01	21.30	43	21.50	2285.	2333.	1043.	34.1
1.01	22.00	44	22.00	2201.	2313.	1040.	34.0
1.01	22.30	45	22.50	2118.	2279.	1034.	34.0
1.01	23.00	46	23.00	2036.	2243.	1028.	34.0
1.01	23.30	47	23.50	1956.	1888.	1025.	34.0
1.02	0.00	48	24.00	1878.	1894.	1026.	34.0
1.02	.30	49	24.50	1803.	1883.	1024.	34.0
1.02	1.00	50	25.00	1729.	1858.	1020.	34.0
1.02	1.30	51	25.50	1657.	1824.	1014.	33.9
1.02	2.00	52	26.00	1587.	1781.	1007.	33.9
1.02	2.30	53	26.50	1517.	1733.	999.	33.9
1.02	3.00	54	27.00	1450.	1679.	990.	33.9
1.02	3.30	55	27.50	1384.	1622.	980.	33.8
1.02	4.00	56	28.00	1320.	1563.	970.	33.8
1.02	4.30	57	28.50	1257.	1504.	960.	33.7
1.02	5.00	58	29.00	1197.	1445.	950.	33.7
1.02	5.30	59	29.50	1138.	1386.	940.	33.7
1.02	6.00	60	30.00	1082.	1327.	930.	33.6
1.02	6.30	61	30.50	1027.	1269.	920.	33.6
1.02	7.00	62	31.00	974.	1212.	910.	33.5
1.02	7.30	63	31.50	924.	1155.	901.	33.5
1.02	8.00	64	32.00	877.	1101.	892.	33.5
1.02	8.30	65	32.50	831.	1048.	883.	33.4
1.02	9.00	66	33.00	788.	997.	874.	33.4
1.02	9.30	67	33.50	748.	948.	865.	33.4
1.02	10.00	68	34.00	709.	900.	857.	33.3
1.02	10.30	69	34.50	673.	855.	850.	33.3
1.02	11.00	70	35.00	638.	812.	842.	33.3
1.02	11.30	71	35.50	605.	771.	835.	33.2
1.02	12.00	72	36.00	574.	732.	829.	33.2
1.02	12.30	73	36.50	544.	695.	822.	33.2
1.02	13.00	74	37.00	516.	659.	816.	33.2
1.02	13.30	75	37.50	490.	625.	811.	33.1
1.02	14.00	76	38.00	464.	593.	805.	33.1
1.02	14.30	77	38.50	440.	563.	800.	33.1
1.02	15.00	78	39.00	418.	534.	795.	33.1
1.02	15.30	79	39.50	396.	506.	790.	33.1
1.02	16.00	80	40.00	376.	480.	786.	33.0
1.02	16.30	81	40.50	356.	455.	782.	33.0
1.02	17.00	82	41.00	338.	432.	778.	33.0
1.02	17.30	83	41.50	320.	410.	774.	33.0
1.02	18.00	84	42.00	304.	413.	770.	33.0
1.02	18.30	85	42.50	288.	406.	766.	33.0
1.02	19.00	86	43.00	273.	400.	761.	32.9
1.02	19.30	87	43.50	259.	393.	756.	32.9
1.02	20.00	88	44.00	246.	385.	750.	32.9
1.02	20.30	89	44.50	233.	377.	745.	32.9
1.02	21.00	90	45.00	221.	369.	739.	32.8

AD-A069 593 NEW JERSEY STATE DEPT OF ENVIRONMENTAL PROTECTION TRENTON F/G 13/2
NATIONAL DAM SAFETY PROGRAM. WYOMING LAKE DAM (DE 00034), JONES--ETC(U)
APR 79 T T MOORE DACW61-78-C-0124

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1.02	21.30	91	45.50	210.	361.	733.	32.8
1.02	22.00	92	46.00	199.	352.	727.	32.8
1.02	22.30	93	46.50	189.	344.	721.	32.7
1.02	23.00	94	47.00	179.	335.	714.	32.7
1.02	23.30	95	47.50	170.	326.	708.	32.7
1.03	0.00	96	48.00	161.	318.	702.	32.7
1.03	.30	97	48.50	153.	309.	695.	32.6
1.03	1.00	98	49.00	145.	300.	689.	32.6
1.03	1.30	99	49.50	137.	291.	683.	32.6
1.03	2.00	100	50.00	130.	283.	677.	32.5
1.03	2.30	101	50.50	124.	274.	670.	32.5
1.03	3.00	102	51.00	117.	266.	664.	32.5
1.03	3.30	103	51.50	111.	257.	658.	32.5
1.03	4.00	104	52.00	105.	249.	652.	32.4
1.03	4.30	105	52.50	100.	241.	647.	32.4
1.03	5.00	106	53.00	95.	233.	641.	32.4
1.03	5.30	107	53.50	90.	225.	635.	32.3
1.03	6.00	108	54.00	85.	218.	630.	32.3
1.03	6.30	109	54.50	81.	210.	625.	32.3
1.03	7.00	110	55.00	77.	203.	619.	32.3
1.03	7.30	111	55.50	73.	196.	614.	32.2
1.03	8.00	112	56.00	69.	189.	609.	32.2
1.03	8.30	113	56.50	65.	182.	604.	32.2
1.03	9.00	114	57.00	62.	175.	600.	32.2
1.03	9.30	115	57.50	59.	169.	595.	32.2
1.03	10.00	116	58.00	56.	163.	590.	32.1
1.03	10.30	117	58.50	53.	157.	586.	32.1
1.03	11.00	118	59.00	50.	151.	582.	32.1
1.03	11.30	119	59.50	47.	145.	578.	32.1
1.03	12.00	120	60.00	44.	139.	574.	32.1

PEAK OUTFLOW IS 2334. AT TIME 21.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2334.	2082.	1283.	606.	72698.
CMS	66.	59.	36.	17.	2059.
INCHES		1.75	4.31	5.09	5.09
MM		44.41	109.43	129.19	129.19
AC-FT		1033.	2545.	3004.	3004.
THOUS CU M		1274.	3139.	3705.	3705.

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PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO APPLIED TO FLOWS 1 1.00
HYDROGRAPH AT	1	11.08	1	2676.
	(	28.70)	(	75.76) (
ROUTED TO	2	11.08	1	2334.
	(	28.70)	(	66.10) (

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	29.00	29.00	32.50
STORAGE	165.	165.	669.
OUTFLOW	4.	4.	272.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	34.05	1.55	1043.	2334.	33.50	21.00	0.00